The FOUNDRY

Volume 54
Number 5

Published
Semimonthly

CLEVELAND, OHIO, MARCH 1, 1926

Sweepers Utilize Castings for Handling Dirt

DRUDGERY of housework has been eliminated practically through the application of various mechanical household appliances on the market and the work is done in a much more thorough and satisfactory manner than when hand methods were used. The vacuum sweeper is an excellent example of the superiority of mechanical methods. The first mechanical sweeper which consisted of a large revolving brush and was used to clean the streets, was introduced in 1880. About the same time the carpet sweeper was developed by R. M. Bissell. Compressed air was introduced in 1898 as a means of cleaning carpet and the system of using only the vacuum principle for cleaning was developed in 1902 by David T. Kenney. Castings play an important part in the construction of the various types of vacuum cleaners, both electric and non-electric. Castings are used for such parts as the nozzle, the fan housing, etc., in addition to the motor housing on the electrically driven types. The castings now are poured in sand molds, permanent molds and are made by the die casting process, aluminum being used in practically all cases. In 1923, the last year for which figures are available, 1,240,742 electrically driven vacuum cleaners were made with a value of $35,981,514 as compared with 739,534 in 1921 valued at $19,752,905.

The Manufacturer Depends on Castings For Most of the Sweeper Parts

Find Where Castings Can Be Sold

CONTENTS

Page

Can Used Sand Be Reclaimed?—By Pat Dwyer 170

Chinese Make Iron Today as in the Dim Past—By Frank A. Foster 173

Judging the Coke Bed in the Cupola—By Ralph A. Knight ... 177

Refine Iron with Alkali Flux—By George S. Evans 180

Describes Loam Molding Methods—By Ben Shaw and James Edgar 184

Permanent Molds Favored for Production Work—By H. A. Schwartz 189

Pattern Changed To Facilitate Molding—By C. J. Morrette. 192

Bill Explains Cause of Shifted Castings—By Pat Dwyer 193

Burning Fuel Oil Efficiently—By Max Sklovsky 196

Screws Fasten Pattern Parts—By Walter C. Ewalt 199

How and Why in Brass Founding — By Charles Vickers 188

Milestones in Foundry Progress 201

The Shakeout 202

Trade Trends in Tabloid ... 203

Comings and Goings of Foundrymen 204

Foundry Equipment Market Reports 208

What the Foundries Are Doing 209

New Trade Publications 210

—⊡—

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON ..... 1037 Old South Bldg.
CHICAGO ..... 1147 People's Gas Bldg.
CINCINNATI ..... 408 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 401 Westory Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND ..... Prince's Chambers
LONDON, ENGLAND ..... 2-3 Caxton House Westminster, S.W.I.
PARIS, FRANCE ..... 23 Rue de la Bienfaisance VIIIe

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single Copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association
Entered at the Post Office at Cleveland as Second Class Matter
Copyright 1926 by The Penton Publishing Co.

Can Used Sand

TO BE strictly accurate and to leave no excuse for misunderstanding or misinterpretation the title should be expanded to read: "Can used sand be reclaimed economically over an indefinite period?" If so, what is the best medium for accomplishing this result. Is there a point in the life of sand where it becomes utterly worthless from a foundry standpoint and where it becomes a positive liability in that it involves an expense in hauling it away to a burial place.

The foregoing and other features have become live issues in the foundry industry in recent years. This is due partly to the more extended introduction of scientific control, a natural desire on the part of foundrymen to standardize methods, turn out a uniform product and to know at any and all times the why and the wherefore of every operation. This trend of course is highly commendable and while in some cases the basic motive may be due to pure scientific interest, still in actual practice the commercial angle receives due consideration.

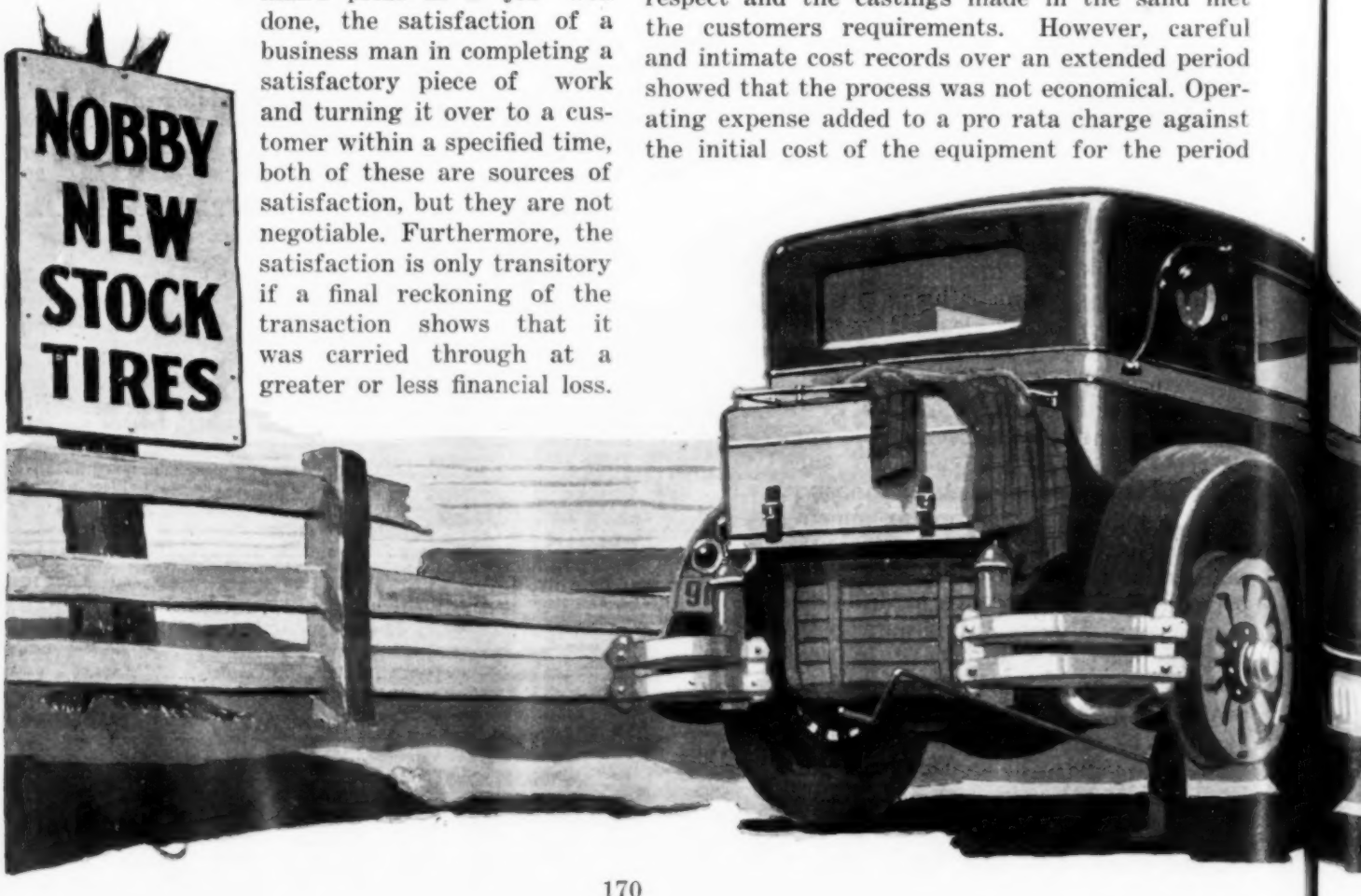
In fact, it is quite probable that this same commercial view is the greatest of the many variable factors connected with the utilization of used sand in the foundry. The pocket nerve is the most sensitive of the many points of contact a man maintains with his business. The craftsman's pride in a job well done, the satisfaction of a business man in completing a satisfactory piece of work and turning it over to a customer within a specified time, both of these are sources of satisfaction, but they are not negotiable. Furthermore, the satisfaction is only transitory if a final reckoning of the transaction shows that it was carried through at a greater or less financial loss.

As every business man knows, or at least all those who have remained in business a sufficient length of time to enable them to draw intelligent conclusions, or to place them in a position where their opinion is worthy of consideration, no business is successful unless it yields a profit.

Untenable in Practice

An experiment may be considered successful from one angle, but it may be set down properly from another angle as a total loss. At various times during the past 20 years men have set out to prove that they could use old sand for the production of castings by simply adding a little clay occasionally. Unforeseen features continually kept turning up to complicate the process. A method which seemed simple enough in theory and even in laboratory experiment proved wholly untenable in actual shop practice.

In other cases elaborate mechanical equipment was installed to reclaim old sand and render it fit for use. The experience of a prominent eastern foundry is typical of what happened in many other places. The sand was satisfactory in every respect and the castings made in the sand met the customers requirements. However, careful and intimate cost records over an extended period showed that the process was not economical. Operating expense added to a pro rata charge against the initial cost of the equipment for the period



dBe Reclaimed?

By Pat Dwyer

it had been in use, exceeded the expense chargeable to molding sand for a similar period, when the sand had been renewed in the ordinary manner by the addition of new sand. To quote the familiar hospital simile "The operation was beautiful and a pronounced success in every respect, but the patient died."

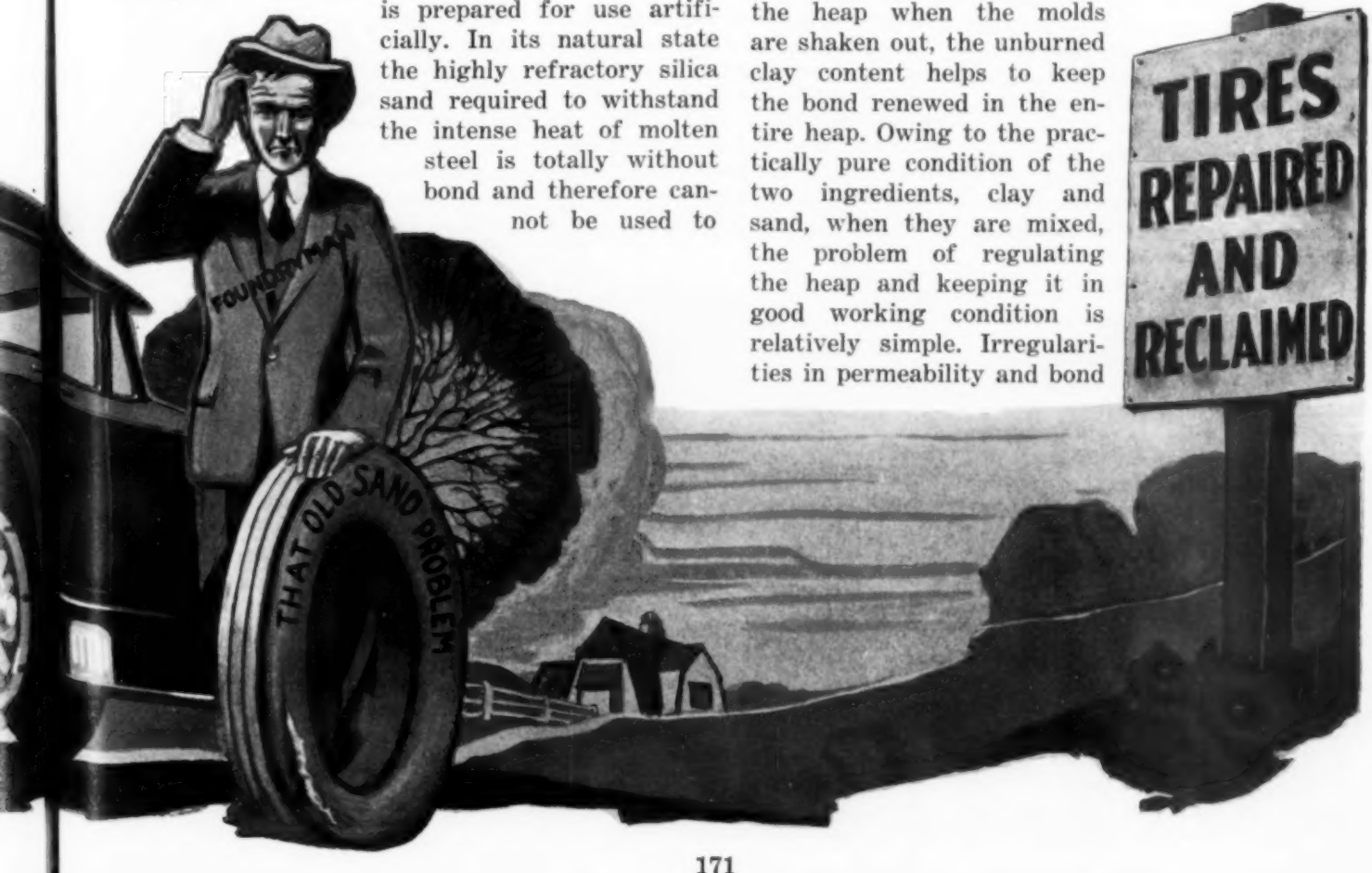
Adding small quantities of clay to used molding sand does not represent anything new or original in molding practice, but only within the past year has the method been carried to an apparently successful issue in several American foundries. The vender of a clay product used in reviving sand claims that many foundries are experimenting with it. The work only has been carried on for the past year and therefore probably has not yet reached a stage where one might be justified in drawing sweeping conclusions.

Steel Foundry Sand

The foregoing reference of course applies only to gray iron and malleable iron foundries. With the exception of one or two deposits of natural bonded sand, all the sand used in steel foundries is prepared for use artificially. In its natural state the highly refractory silica sand required to withstand the intense heat of molten steel is totally without bond and therefore cannot be used to form a mold. It might hold its shape for a short time while in a damp state, but the instant the water evaporated either through atmospheric attraction or through the application of artificial heat, the sides of the mold would crumble and the sand would run to the bottom as readily as at other times and under other conditions it filters through a small opening from the top to the bottom section of an hour glass.

Addition of clay to silica sand always has been regarded as ordinary steel foundry practice and, therefore, so far as the purpose of this series of articles is concerned has no bearing on the subject at issue. In many steel foundries the clay is added in some form of muller to a quantity of new silica sand in the proportion of one part of clay to 10 parts sand. For light, green-sand work a certain amount of old sand is incorporated in the mixture. The amount will depend on the thickness of section, the size and the shape of the castings and to some extent on the refractoriness of the original new sand and the type of melting medium employed for the steel. As a general rule the metal melted in the open hearth furnace is milder in its effect on the sand than metal melted either in the converter or in the electric furnace.

Only the sand used for facing is treated in this manner and as it passes into the heap when the molds are shaken out, the unburned clay content helps to keep the bond renewed in the entire heap. Owing to the practically pure condition of the two ingredients, clay and sand, when they are mixed, the problem of regulating the heap and keeping it in good working condition is relatively simple. Irregularities in permeability and bond



strength readily are detected and the proper remedies easily applied.

An entirely different set of conditions prevail in the gray iron and malleable iron foundries. They also prevail in the nonferrous foundries, but since no nonferrous foundries, so far as knowledge extends, have attempted to rejuvenate sand simply by the addition of clay, they will be omitted from this discussion.

Sand suitable for making iron castings, either gray iron or malleable, is found in a natural condition in nearly all parts of the world, and deposits usually are available within reasonable distance of the point of consumption. Certain sands have peculiar properties which render them particularly appropriate for making definite classes of castings and this gives them a reputation and secures them a market far beyond that which would be their's under ordinary conditions.

The most notable of these sands in America are the so called Albany sands found on both sides of the Hudson or North river in New York state. Besides finding extensive use in their own immediate territory they are shipped to almost unbelievable distances considering the freight rates demanded.

Sands from this territory are graded according to size of grain and amount of bonding material and the classification includes varieties ranging from the finest, that is sand suitable for light aluminum and brass castings, up to a coarse grade that yields satisfactory service on heavy gray-iron castings. Structure of the grain, composition of the bond and thorough natural blending render this sand ideal for the manufacture of stoveplate, locks, hardware, ornamental iron, sanitary ware and light castings.

Tests On Sand

Life of this sand together with many other interesting features disclosed in an extensive number of tests were discussed in a paper entitled *The Life Of Molding Sand* presented by C. M. Nevin, before the Syracuse convention of the American Foundrymen's association, October, 1925. Contrary to general belief based on actual experience he found that the life of Albany sand is less than that of some other contemporary sands and this conclusion led him to doubt the value of the tests. He admitted that the term really is indefinite and depends for its application on local conditions. He suggested a method for testing specimens that approximates actual casting conditions. The amount of bond material and the colloidal condition of this material which included quality and rehydrability are the important factors to be considered.

He also found that as a rule permeability increased with heat treatment of the sand due to the formation of compound grains. Compression tests practically lead to the same conclusions as bar tests when used on a series of heat treated sands. Determining comparative durability by heating the sand to 600 degrees Cent. and then getting the loss in strength is not a satisfactory method in its present form.

In other words the result of this series of tests was purely negative so far as adding to the sum total of human knowledge of molding sand is concerned. The same of course is true of a great deal of experimental work carried on in any line and if it serves no other purpose it will prevent further waste of time by others engaged in the same line of research.

Results sometimes are secured by a series of tests directed definitely toward proving a certain point. At other times tests are carried on through a more or less extended process of elimination which finally uncovers the secret at the bottom of the hidden well.

Furnish Information

Much laboratory work has been carried on in connection with molding and core sand. A definite step toward standardization has been made by the American Foundrymen's association in adopting method, equipment and empirical enumeration in recording permeability, bond and strength of sand. In several instances foundrymen have succeeded in co-relating the laboratory tests with their shop practice, but the great majority of foundrymen still have only the haziest idea of the subject.

As business men they are interested in any idea that will enable them to cut production costs, but up to the present they have not been able to take advantage of most of the information presented on the subject of sand conservation and reclamation. Frankly and in the language of the day it has been over their heads.

The various discussions have been linked so intimately with test tubes, centigrams, filter paper, balances, dye absorbption and long paragraphs dealing with one or two grains or at most a small quantity of sand, that the foundryman without a laboratory decided it would be useless on his part to attempt any investigation.

Other foundrymen located in favorable positions where sand is cheap and plentiful congratulated themselves on their location and decided not to trouble themselves about the subject, but continue their present practice whatever it might happen to be.

Still a third class of foundrymen and they are the real majority cannot understand why an association or a committee or something cannot develop a simple set of tests by which an ordinary person can decide whether a sand is suitable for a given purpose. They are not interested in the scientific features, the atomic theory, capillary attraction or the curious natural law that causes clay to absorb indigo dye.

Cannot Learn Everything

They claim, and with some degree of justification, that life is too short and their other duties are too arduous to permit them to pursue an extended scientific investigation. They admit that long, patient and highly scientific investigation is required before any process or method is placed on a workable basis, but they are not interested in the detail of this investigation and only mildly interested in progress reports. They want a finished, practical, workable job placed in their hands before their interest is aroused.

A man does not need to be an electrical wizard to use a telephone, to snap a switch and flood a room with light or to throw in a contact lever to start a motor. Millions of people drive automobiles who know nothing of the internal combustion engine or of the exceedingly long and costly series of experiments leading up to the present product. A touch on one lever starts the engine. A touch on a second lever throws it into gear, either forward or backward and a touch on the wheel directs the vehicle either to the right or the left.

The average foundryman is interested in sand conservation and reclamation in the same manner and to the same extent that he is interested in any feature that promises a reduction in cost or an increase in production, or both; but he is not going to do any experimenting or depart from established routine until methods of sand testing and control are developed to a point where they safely may be entrusted in the hands of the typical foundry workman.

To clarify the subject and present a resumé of what has been done up to the present THE FOUNDRY will present the result of an investigation recently conducted by correspondence and through personal interviews with prominent foundrymen who have departed from the beaten path and who have tried other means and materials

(*Concluded on Page* 187)

Fig. 1—Mountains of Used Crucibles Testify to Long Years of Production

Iron Smelting Works Located Near Ping Ting Chow, Shansi

Chinese Make Iron Today

As in the Dim Past—By Frank A. Foster

SUPERSTITION seems to have prevented a full development of China's mineral resources. The people did not dare to dig deep holes into the ground for fear of disturbing the spirits of the earth, so they had to content themselves with open surface cuts where minerals were found. Evidently a gradual change came over them and increasingly deeper shafts have been dug. Many excavations now are of considerable depth, especially in coal and iron mining.

Iron is found in many localities in China and some of the mines have been worked for centuries. It is thought that the supply of ore is not as great as in America and some other countries but there is a large reserve yet untouched. The quality of the ore varies. In some localities it is exceedingly good. The deposits from which the smelting works of the great Han Yeh Ping Co. of Hankow and Hanyang derives its ore probably are among the largest in China and the most extensively worked. They turn out large quantities of pig iron and other iron products.

Several other extensive modern plants utilize the iron resources of China. Most of these are under the direction of foreigners and they probably are forerunners of many others which may be developed as soon as the country gets over the turmoil of transition from the old conditions to the new.

An interesting iron producing region which has been operating for a long time is that in the vicinity of Ping Ting Chow (pronounced Ping Ding Jo) in the province of Shansi. These mines are located up in the mountains some distance from the only railway in the province. The methods employed in all the operations are crude and undoubtedly represent the methods used for many centuries in that vicinity.

The antiquity of these workings is evidenced by the immense quantities of refuse and old discarded crucibles to be found near the smelting works.

Fig. 2—Left—Mines Are Located in the Rugged Mountain Sections. Fig. 3—Only in Recent Years Have the Spirits of the Earth Been Braved by Deeper Shafts

Fig. 4—Above — Laying the Bed of an Iron Smelting Furnace, Using Pieces of Broken Crucibles

Fig. 8—Above — The Contents of Several Crucibles Are Concentrated Before Pouring into Pig Molds

Fig. 5—Above — The Preliminary Roasting Is Carried on in Long Crucibles Heated by Coal with Natural Draft

Fig. 6—Below — The Second Operation Requires Forced Draft to Melt the Iron Granules in Smaller Crucibles

Fig. 7—Below — In Taking the Crucibles from the Furnace They Are Rocked to Remove Ashes and Slag

Fig. 9—Below — The Mixture from Several Crucibles Is Poured into Pig Molds Slightly Smaller than the Common Size

Fig. 10—Pack Loads of Coal and Ore at the Mines Are Arranged So That the Saddles May Be Lifted to the Ground Without Unpacking

The ore is reduced in locally made clay crucibles and when the latter are discarded they often are filled with earth and piled up like cord wood to make walls and retaining banks on the hill sides. They are even used to make the side walls of houses and the high walls surrounding the home plat. Such a wall is seen in Figs. 1 and 13.

The principal product of this region is pig iron. Some of this is more in the nature of wrought iron because the carbon content is extremely low. Some of this pig iron is made into wrought iron bars from which scissors, knives and axes are made locally. Another local use for this iron is in casting iron cooking pans of a surprising thinness, a description of which will be given later. In some places copperas or green vitriol also is made from the ore.

The following description of the iron ores of Shansi province is given by Prof. T. T. Read, bureau of mines, Washington, and formerly professor of metallurgy, Pei Yang university, Tientsin. It is taken from his article "The Mineral Production and Resources of China" which was published in the transactions of the American Institute of Mining Engineers. Prof. Read says:

The iron ores of Shansi are limonite and hematite, occuring in shales and limestones of the carboniferous age. Usually they are in masses of no great size, commonly in or near a disturbed zone in the strata, or else in beds or flat veins, from a few inches to not more than 3 feet thick, of limited extent. Therefore, it follows that no sufficient supply of uniform quality can be obtained from the Shansi deposits, so far as yet explored to form the basis for blast furnace work on a large scale. More recently it has been reported that on the southern border of this district, in Honan province, a suitable deposit has been found, and it is proposed to erect another government iron-works similar to Hanyang.

Two analyses of ore from T'ai Yang, near Tze-Chou-fu are given by W. H. Shockley, as reported in the transactions of the American Institute of Mining Engineers:

Iron Ore from T'ai Yang

	I	II
Fe	53.88	45.50
Si O	4.67	11.15
Al_2O_3	3.46	6.42
Mn O_2	0.57	0.51
Ca O	2.21	5.50
Mg O	trace	0.25
P_2O_5	0.57	1.08
S	0.074	0.916
C O_2	9.37	2.70
H_2O	2.20	7.35

The ore is taken from small shafts or adits, as shown in Fig. 2, in the hillsides. Fig. 3 shows the head-

Fig. 11—Pack Loads of Kuo or Iron Cooking Pots Leaving the Smelters for the Coast Towns—The Roads Are Crucible Clay Pulverized for Use by the Hoofs of the Pack Mules. Inset—Thin Cast Iron Pots Made at the Smelter

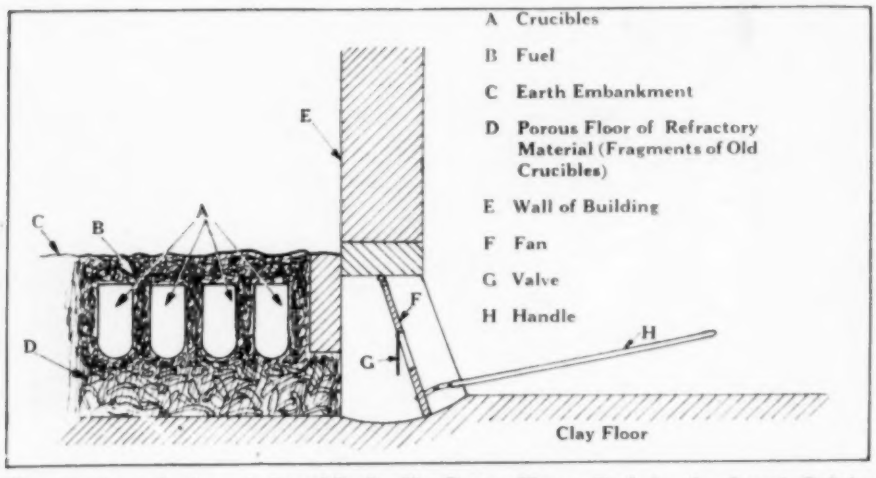


Fig. 12—Cross Section of Forced-Draft, Man-Power Blower Used in the Second Refining Operation

works of one of these shafts. The hoisting is done by a one-manpower engine. The drum of the hoist is mounted on the end of a horizontal wooden shaft held firmly in place by heavy stones. The drum can be slid off the shaft easily and is carried home at night for safe keeping. The little brick shrine on the wall shelters an image of the spirit of the mine.

Sorted by Grades

The ore is broken up into small pieces and sorted into several grades to be sold to the smelters usually located near the mine. At the smelting works it is packed in crucibles with 50 per cent volume of coal. Coal is abundant in this region.

The crucibles in which the ore is reduced are made locally from clay found in the region. The usual size of the crucibles used in the first step in refining is about 5 inches diameter and 45 inches deep with a spherical bottom. Of course, the clay first has to be pulverized quite fine. The manner of doing this in this locality shows the ingenious thrift of the people. To pulverize this clay by machinery would be too expensive for them so they put it in the trail traversed by the mule and donkey trains transporting materials and let the hoofs of these animals do the work. In Fig. 13 the boy sitting beside the road is sifting the clay throwing all lumps back into the road for further pulverizing.

The crucibles are packed and placed in rows in a rectangular enclosure made up of earth packed into old discarded crucibles. From 250 to 275 of these long narrow crucibles can be put into one furnace. These are out in the open air. The floor of the furnace on which the crucibles are placed is composed of a thick layer of fragments of old crucibles so as to make a porous and refractory layer through which the air can circulate freely providing natural draft for the fire. Fig. 5 shows the manner of charging or packing these pit furnaces. Coal is packed around and over the crucibles and the fire lighted at the bottom and kept burning around the crucibles for three days.

Fig. 13—The Boy at the Right Is Sieving Clay Crushed by the Mules Hoofs, Preparatory to Making Crucibles

This first reduction is only preliminary. After the crucibles have cooled sufficiently for handling, they are emptied and the contents divided. The contents consist of an irregular metallic fragment or bloom, smaller fragments of metallic matter and coke. The bloom often clings to the bottom of the crucible, necessitating breaking the bottom to obtain it.

Sell the Bloom

The bloom is sold to the makers of wrought iron, the low percentage of carbon making it quite malleable. The bloom is worked down into bars in a wood or charcoal fire. The charcoal is made from the roots of scrub oak, stacked in a cave dug out of the side of a hill. The fire is started and the hole nearly stopped up, leaving just enough draft to insure slow burning. These roots are dug and brought to the kiln for 3½ cash per catty, equivalent to about 98 cents a ton United States currency. The charcoal is sold to the smelters at 23 cash per catty, $6.46 United States currency per ton. One of the uses to which this wrought iron is put locally is the making of shovels.

A considerable part of the wrought iron finds its way out into distant markets. Shipments of these bars is made by camel train to the railroad about 50 li or 16 miles distant.

The smaller pieces of iron are mixed with coal and placed in smaller crucibles, about 7 inches in diameter and 14 inches high such as those shown in Fig. 6. In packing these crucibles with fuel they also put in a certain amount of a black dust, called *hu tu* or black earth. Although they apparently do not know the composition of this dust, they have found, by experience, that it makes the resulting iron flow freely and enables them to make castings of extreme thinness. This dust is decomposed coal, rich in phosphorus, which gives the iron great fluidity.

Fig. 4 shows the method of laying the floor of a furnace for the second

Phosphorus and Sulphur Contents of Chinese Iron

Sample	Locality	Phosphorus per cent	Sulphur per cent	Remarks
1	Li-Chia-Chuang	1.7314	0.5489	Clean, Malleable.
2	T'ao P'o	0.4671	0.1784	Dirty, Malleable.
3	Yang-Chia Chuang	4.8400	0.4577	Rather clean, Brittle.
4	Nan Yao Kou	2.6066	0.2486	Dirty, Globular.
5	Chien-mu P'ing	0.8527	0.1254	Dirty, Porous, Brittle.
6	San Ch'uan	0.6854	0.1365	Clean, Porous, Brittle.
7	Yang Shu Kou	1.5073	0.6140	Dirty, Porous, Slight Mall.
8	San-tu	0.4645	0.4945	Dirty, Porous, Slight, Mall.
9	Ing-ying	3.5700	0.6375	Clean, Hard, Massive.
10	Han-ho-Kou	3.7645	0.2999	Clean, Hard.
11	Wu-tu	0.7315	0.2155	Clean, Malleable.
12	Yang Chu Hsien	6.9540	0.2196	From a Cast Iron Bar.

Note in the last sample, the high percentage of phosphorus in the cast iron bar.

melting. About 80 crucibles are placed in a furnace similar to that for the first process, but the melting is carried on at a greater heat produced by a forced draft. Fig. 12 is a diagram showing the construction of the blower for the forced draft. The furnace is located outside the building, but with the back wall against it. In the back wall is an opening into which is fitted a swinging wing or flap, pivoted at the top, and just clearing a concave hearth of fire clay. The swinging flap is moved back and forth by a long pole which is operated by a man inside the building. The lower part of the flap drives air through the porous material forming the lower part of the bed of the furnace. It is so hot in there that the workman strips stark naked and even then he has to be relieved frequently. Generally two of these valves are supplied to a furnace.

When the iron is melted, the cover of fuel is removed from the crucibles and they are lifted out, one at a time, by long handled tongs which grasp the sides as shown in Fig. 7. As they are lifted out, the tongs are rested on the top edge of the furnace and the crucible quickly rocked from side to side to throw out the loose ashes, coke and slag, before they are lifted clear of the furnace. Fig. 7 shows this process. Each crucible contains only a small quantity of iron so several crucibles are emptied into one before the iron is poured into the pig molds. Fig. 8 shows the concentration and Fig. 9 shows the pouring into molds. Usually these furnaces are built in multiples so that one can be opened each day, pouring about 1000 catties a day. A catty is equal to 1 1/3 pounds. This iron sells for 40 cash per catty, equivalent to $11.24 United States currency, per ton.

A total force of 18 men is employed in the smelting work. Native Chinese say that the smelter, where some of these pictures were taken, has been running more or less each year for some 500 years. The workmen all are local residents and when the fields require working at planting and harvest time, the smelters stop work. Also, in the hottest weather of summer and the coldest of winter the smelters are not operated.

Ore and Coal Plentiful

There seems to be an unlimited amount of ore in the mountains nearby, in their estimation at least. Whether any real scientific investigation has been made to prove this, the writer is not able to state. Coal and fire clay both are abundant and conveniently at hand. Coal is bought at the remarkably low price of one cash per catty. This works out to about 28 cents, United States currency per ton.

Since the World war, the prices for iron are much higher and now these iron mines and smelters are worked more than before the war. Although the iron content of the ore is not high, the grade is good.

The accompanying table shows the average phosphorus and sulphur content of pig iron from this region as determined by Cheng Fu Wang and reported in an account of this industry written by T. T. Read, of the bureau of mines, Washington, and recorded in the transactions of American Institute of Mining Engineers.

This pig iron is shipped out by donkey or camel train and for convenience of handling and packing on the saddles it is cast in smaller size pigs than those made in America or England. As the pigs often have to be carried long distances in the saddles, they are packed so that the load can be lifted from the animals' backs without unpacking. In Fig. 10 a pack train load of coke or coal is seen unloaded.

Necessity for economy in the use of metal, centuries ago, taught the Chinese to reduce the amount of metal in any given article to the lowest possible limit. Many articles used in the household or in agriculture by the common people are cast in sections that are surprisingly thin. Many such articles are made in the vicinity of these Ping Ting Chow smelters, utilizing the metal produced there. Among these the cast iron cooking pans are perhaps the most surprising. Fig. 11 shows a donkey train load of these pans on their way to distant markets. These are all made in one general shape like those shown on the donkeys' backs and in the inset of Fig. 11 and in all sizes from 6 to 8 inches to as many feet in diameter. Pans 3 feet in diameter are usually not more than 1/16-inch thick, except at the gate, where the section is a little thicker. The high percentage of phosphorus in the iron used, is the factor which has made these thin castings possible. The iron flows into the smallest spaces of the mold with great freedom.

This is the second of a series of three articles by Mr. Foster describing Chinese foundry and metal working practice. The third covering modern foundry operations will appear in an early issue.

The Editors.

Judging the Coke Bed in the Cupola

BY RALPH A. KNIGHT

MUCH difficulty is encountered by the foundryman in judging the coke bed when melting in the cupola, since that is practically the only melting unit in use where it is not possible to see and control the action inside. Peep sights have been tried with little success, since only a small portion of what actually is happening is shown, and the resultant findings are of little or no value to the man in actual practice.

The coke bed usually gives the answer to good or bad melting practice. Most of the trouble encountered is due to a small slip on the part of the foundryman, and when he once gets into trouble, he usually throws up his hands and laments the fact to others. An example recently noted shows how easy it is to get into trouble and how hard it is to get out. The foundry in question was running at its normal rate, melting about 7 tons a day and getting an iron of good quality. The cupola was 36 inches in diameter, 600 pound charges were used, and the melting was done with an 85 pound split of coke for fuel. Business picked up and it became necessary to melt about 15 tons per day. Then the trouble began. Apparently the first half of the heat was good, but the last half was oxidized badly, it being necessary to pig some of the melt as it absolutely was not fit for pouring purposes. The logical solution of this case was to fatten the splits after a certain point or add more coke to each split from the start. After a long cut and try process the coke finally was adjusted to 100 pounds per split and the iron became normal through the entire heat.

Conditions similar to this exist in foundry practice today in practically every foundry in the country, although perhaps in milder forms. An easy correctional measure and a quick

one is discussed in the following.

By a simple method of checking the charges in at the door and the taps coming out of the spout, and plotting the results as shown in the accompanying illustration, two lines are obtained, one representing the taps in pounds against time, the other, charges in pounds against time. This applies to batch melting, although in continuous melting the results are about the same. In the writer's experience both the batch melt and continuous melt present practically a straight line. However, the charges do not present a straight line unless conditions are ideal, and in that case both lines should be nearly parallel. The type of curve indicates the condition of the bed when a certain tap comes down or, in continuous operation, at what time during the heat the bed changes. After making about two curves of this type they will indicate when to make a change. Thus avoiding overbuilding the bed or allowing it to go down so far that correctional measures are useless.

The taps, batch melt, are plotted in reference to time and pounds in Fig. 1 and present a straight line. The charges going in the door were checked just as the taps were taken and plotted pounds against time. From the type of curves obtained on this test it is evident the bed has dropped. This is shown by the fact that more pounds of iron have gone in the door than have been taken out. More coke is the solution and the melter has his choice of adding the extra coke to each split or adding the coke just before the time the bed drops, as both methods will do the work. However, the writer prefers adding from the start, the reason being that in case the size of heat increases or decreases the same quantity of coke may be used for a split in either case. Fig. 2 shows the lines after the correction, while the dotted line on Fig. 1, shows the opposite of the above mentioned case namely when too much coke is used. Fig. 3 merely shows a continuous operation curve indicating that there is no difference.

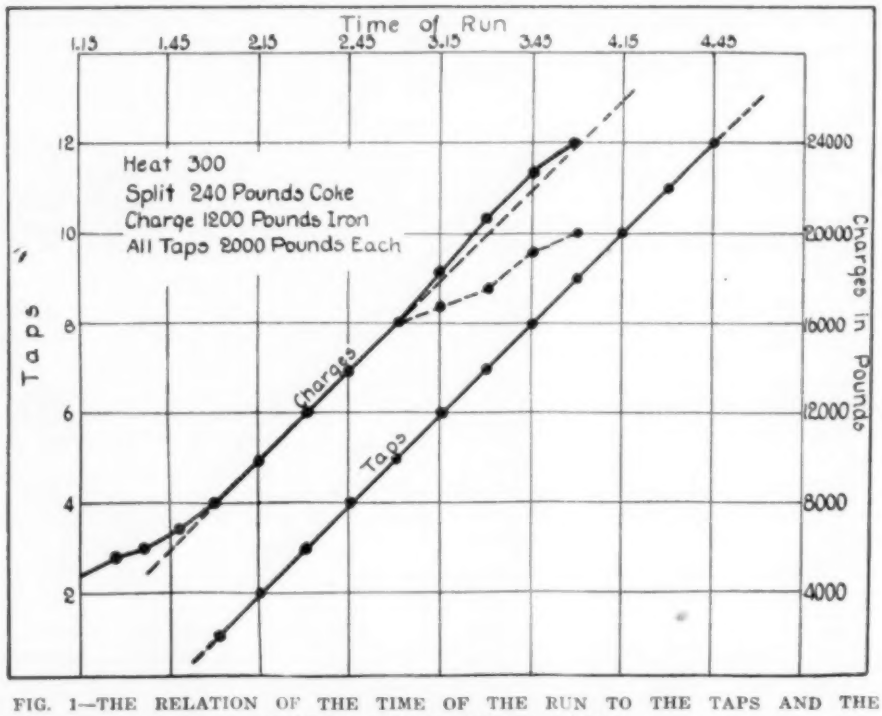


FIG. 1—THE RELATION OF THE TIME OF THE RUN TO THE TAPS AND THE CHARGES MAY BE NOTED EASILY

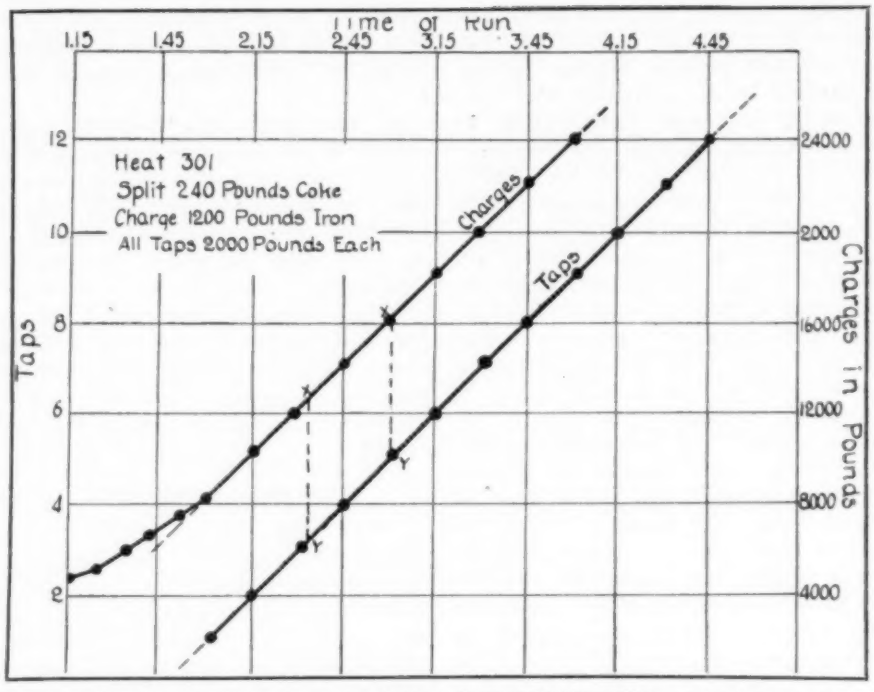


FIG. 2—AFTER CORRECTIONS ARE MADE, THE RELATIONSHIP ASSUMES A MORE IDEAL CONDITION. LINE XY INDICATES AMOUNT OF IRON IN THE CUPOLA

The time factor in melting is vitally important and every melter should carry his watch with him and know just when every pound of iron goes in and comes out of the cupola. No foundry can get the best results if conditions are simply haphazard. Some foundries still mix and weigh their charges with a fork. To get the best results every charge should be mixed by analysis and weighed out individually. Coke should be measured in tubs. Good results cannot be obtained unless modern methods are used.

A simple method of keeping an up-to-date knowledge on the bed is to weigh what is put in for a bed and weigh what drops out after the heat. A sample would be:

	Pounds
Coke used for bed	1200
Coke drop	1160

In a case like this the difference is so small it may be neglected, but should the difference be about 200 pounds, correctional measures are necessary and with the aid of plotted chart the foundryman may find out exactly the troubles or what time the bed was building or dropping.

Sample methods of tabulation are given as follows:

Continuous Melt

Bed, pounds	Drop, pounds
Time	Charges in
1:30	5
2:00	8
etc.	etc.
Size of Charge	pounds

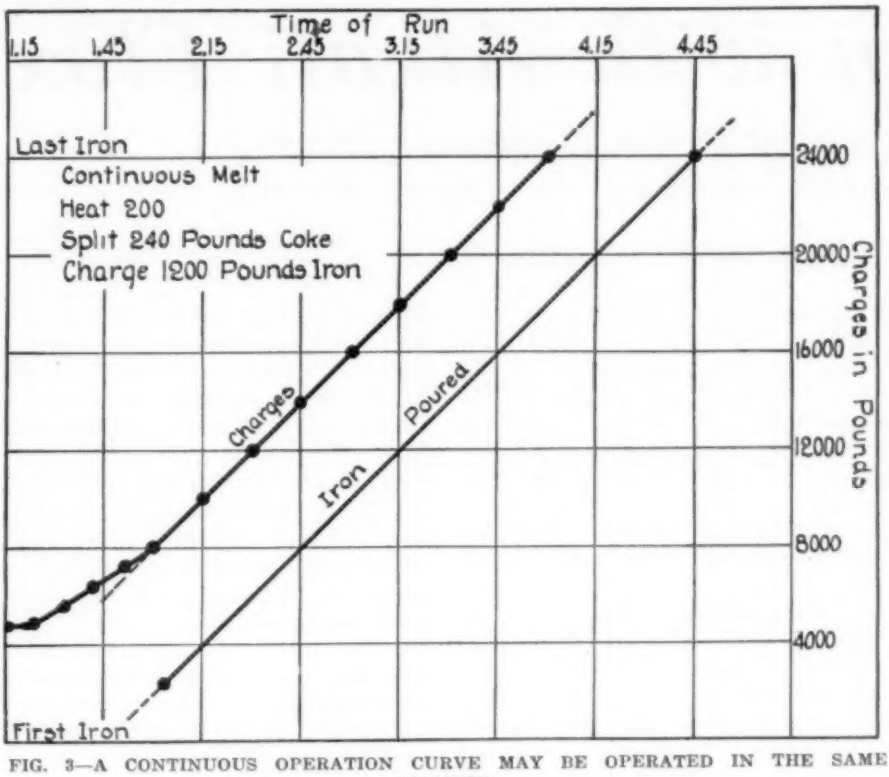


FIG. 3—A CONTINUOUS OPERATION CURVE MAY BE OPERATED IN THE SAME MANNER

	Batch Melt	
Bed, pounds		Drop, pounds
Taps	Time	Charges in
1	1:30	4
2	1:50	7
etc.	etc.	etc.

Size of Tap .....pounds
Size of Charge .....pounds

This method of tabulation gives you all that is needed. The assumption in batch melting is that all taps are of uniform size. If they are not, use the same method as in the case of the continuous melting is used.

The line *XY* on Fig. 2 indicates the quantity of iron in the cupola at any time.

Analyze Markets

The industrial machinery division of the bureau of foreign and domestic commerce, Washington, recently has published a booklet entitled "Analyzing Foreign Machinery Markets Statistically." This publication sketches briefly the usefullness of the industrial machinery export statistics compiled by the department of commerce and contains a glossary of the classification in effect Jan. 1, 1926. Companies which have not received a copy of the booklet may secure one by applying to the industrial machinery division, bureau of foreign and domestic commerce, Washington.

Theodore Kauffmann, president, S. Obermayer Co., Chicago, accompanied by Mrs. Kauffmann, left Feb. 20 for a cruise through the West Indies.

French Publish Book on Foundry Laboratories

The necessity of controlling the analysis of pig iron in a foundry many times has been advocated by the Association Technique de Fonderie of France, and its committee on methods of pig iron analysis, headed by Albert Portevin, has issued a useful booklet of 45 pages on the subject. The object of the authors was to furnish the average foundryman with simple information on the most efficient manner to organize a chemical laboratory at small cost, and to summarize a number of standard methods enabling them to control the analysis of their products easily and economically.

The first section of the book deals with the manner in which samples should be taken. When the samples are taken during the melt they should be taken at the beginning, at the middle and at the end of the melt; the liquid metal will be cast into small bars which will be broken, and samples will be drilled out of the center of the section. When samples are taken from pigs, one pig out of every 10 or 20 should be taken at random, from which samples also will be taken from the center of the section after the pig has been broken. For samples taken from heavy castings the metal should be taken by drilling and leaving out the outside metal; for small castings where the composition of the metal all through the piece is of importance the sample should be obtained by drilling a hole through the casting.

Owing to the fact that in gray cast iron the graphite separates itself from the other metallic particles, it is advisable to sift the drillings and then take proportionate quantities of the metallic powder and the portion remaining on the sift and which contains the graphite.

The following section of the book describes a limited number of methods of chemical analysis. For total carbon the method of direct combustion of the metal in oxygen is given. For combined carbon the Eggertz method is described. The proportion of silicon is obtained by oxidizing the metal and weighing the silicon. Phosphorus is obtained by precipitation by the molybdic reagent. Sulphur is calculated by transforming it into sulphuretted hydrogen which is measured by the potassium iodate. Two methods are suggested for calculating manganese; one is the persulphate method, the other the lead peroxide method.

The book then offers suggestions as to a simple way of organizing the laboratory itself and lays particular stress on the ventilation question. It supposes that the laboratory will be fitted to give three complete analyses per day, or from 3 to 10 analyses for the calculation of the percentage of carbon, silicon, and manganese. A complete description of the necessary equipment is given. It is supposed that the work will be entrusted to one chemist or metallurgist with one assistant.

A final chapter sets down a few rules and suggestions as to the relations that should exist between the metallurgist and the foundry manager and the foreman.

Form New Company

Clive and Claude Parsons have resigned their seats on the board of William Jacks & Co., Ltd., whose offices are in London and Birmingham, England, and which they have managed since the armistice. These gentlemen have joined with W. Hugh Crosland and have formed their own company, to be known as Parson & Crosland, Ltd., whose head office will be situated at Adelaide house, King liam street, London, E. C. 4, with branches in Birmingham and Glasgow. The chairman of the new compny will be E. B. Butler Henderson, who is a director of one of the principal railroad groups of the United Kingdom and other large companies. Parson & Crosland will continue to act as iron, steel and pig iron merchants for export and home trade.

Refine Iron with Alkali Flux

Sulphur Reduced and Oxides Removed at Temperatures Ordinarily Attained in Cupola Practice

By George S. Evans

WITH a better knowledge of the chemistry of cast iron, produced in the cupola, many improvements in mixture composition have resulted. The use of steel scrap has become more or less general even for light castings. Low phosphorus pig iron, formerly used only for steel making, has replaced the high phosphorus brands. Scrap in the mixture is recognized as essential in certain classes of high grade work, and other practices formerly considered impossible are regularly followed today with advantage to the industry.

Alloy additions of nonferrous metals and other methods of refining the structure and composition of cast iron result in castings with almost unbelievable strength, regularly over 50,000 pounds ultimate tensile strength. Many improvements in cupola equipment and design have taken place. A regenerative cupola has been perfected which is claimed to effect a fuel saving of 20 to 30 per cent and to afford closer control over operations. Developments for harnessing the waste heat passing up the cupola stack for other purposes are under way and look promising. It is predicted that developments in metallurgy and cupola practice just have started.

The practical application of the use of manufactured alkalies for desulphurizing and refining cast iron is one of the more recent developments in cupola practice and represents a valuable contribution to the iron castings industry. The German foundrymen were probably the first to make practical use of modern manufactured alkalies in the foundry. Chemists have known for years that sulphur and other impurities in cast iron could be reduced with the alkalies. The chemistry of the reactions both in the ladle or forehearth and in the cupola are simple enough and theoretically sound. This is apparent to everyone familiar with the rudiments of chemistry, but it required a necessity to bring the application to foundry practice into being.

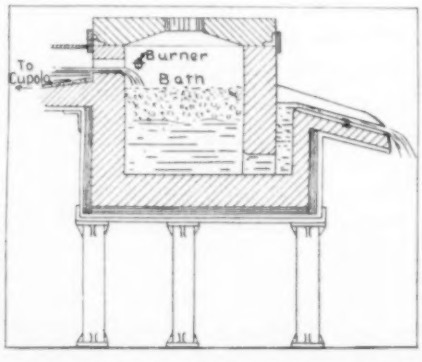


FIG. 2—CROSS SECTION OF FOREHEARTH

With complete remelting of practically the entire tonnage of chilled iron wheels in railroad service every six to eight years, sulphur and other impurities in the metal gradually have increased. It is evident that this would continue indefinitely and that some method of removing the impurities was necessary to save the metal in the scrap wheels for continued use. Consequently the subject of refining molten cast iron has come into prominence in the past few years, and development work leading to the perfection of practical methods which would be applicable to average foundry conditions, has been carried on by numerous foundrymen.

The writer had charge of cupola operations at the 10 plants of the Griffin Wheel Co., Chicago, for a number of years prior to 1925. During this time it was his good fortune to direct research work pertaining to the subject which covered an almost unlimited number of tests of both chemical compounds and methods.

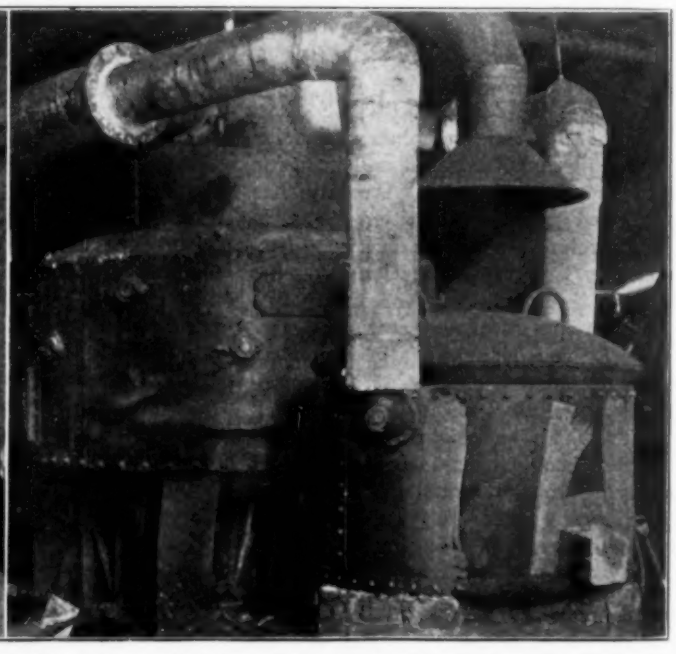


FIG. 1—VIEW SHOWING THE USE OF THE TEAPOT RESERVOIR LADLE AS A MIXER. FIG. 3—FOREHEARTH ATTACHED TO CUPOLA SHOWING AN ARRANGEMENT TO UTILIZE WASTE HEAT FROM THE CUPOLA

Finally an alkali compound was developed and a system or process for refining molten cast iron which surpassed expectations, was perfected. The process was applied to each of the 10 foundries of the company with but few changes in old equipment and without interfering with the routine of foundry operations.

Active Reagent Is Basic Alkali

The active reagent in this compound is sodium oxide, a highly basic alkali with a comparatively low fusion point. This possesses a strong affinity for sulphur, silicious and metallic oxide slags usually present in cast iron. Reactions going on in the refining may be illustrated as follows:

$$Na_2CO_3 + \underset{MnS}{FeS} = Na_2S + \underset{MnO}{FeO} + CO_2$$

$$Na_2S + \underset{2MnO}{2FeO} + Na_2CO_3 = 2Na_2O + \underset{2Mn}{2Fe} + SO_2 + CO$$

$$Na_2O + \underset{FeS}{MnS} = Na_2S + \underset{FeO}{MnO}$$

$$Na_2S + \underset{2MnO}{2FeO} = 2NA + \underset{2Mn}{2Fe} + SO_2$$

$$2Na + \underset{FeO}{MnO} = Na_2O + \underset{Fe}{Mn}$$

$$2Na + FeO.SiO_2 = Fe + Na_2O.SiO_2$$

$$Na_2O + 3C = 2NaC + CO$$

The sulphur in cast iron usually is combined with manganese to form manganese sulphide, to a point where all of the manganese is satisfied and any remaining either is combined with iron to form sulphides or exists as gaseous sulphur. In the refining sulphur is removed by direct absorption of the sulphur compounds and by the reactions given. Iron and manganese set free by the reaction are returned to the bath. With dirty irons the quantity of these elements returned is appreciable in some instances. Sulphur dioxide, carbon dioxide, monoxide and other gases formed pass off into the air. The monoxide of carbon comes off well above the ignition temperature of this gas and immediately burns to the dioxide upon contact with the atmosphere. Sodium silicates formed are fluid and rise through the iron and are absorbed by the slag.

Both the free sodium compounds and sodium silicates formed have a strong affinity for oxides and slag particles floating in the molten metal. These are absorbed through chemical combination and by a scrubbing action similar to that in the open-hearth or electric furnace during the refining process in the manufacture of steel. The reactions between the impurities in cast iron and the alkalies at the temperature of the metal from the cupola are similar to those which take place with limestone at higher temperatures. In the electric furnace for instance, sodium oxide and calcium oxide (lime) are similar in many chemical properties, the difference being largely in the temperatures at which the two chemicals are active.

Sodium salts are highly active and form a fluid slag at the temperature of molten iron coming from the cupola; while lime is not as active at this temperature. Several alkali desulphurizers are on the market today including one or two imported from Germany. Sodium oxide appears to be the principle active reagent in all that have come under the writer's observation. One or more such compounds contain caustic soda which tends to lower the melting point. This is probably advantageous under certain conditions.

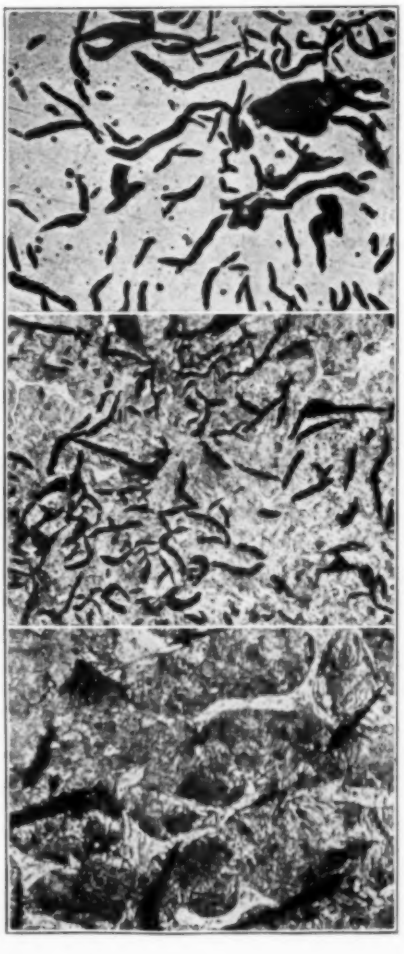
The alkalies offer two possibilities in the iron foundry:

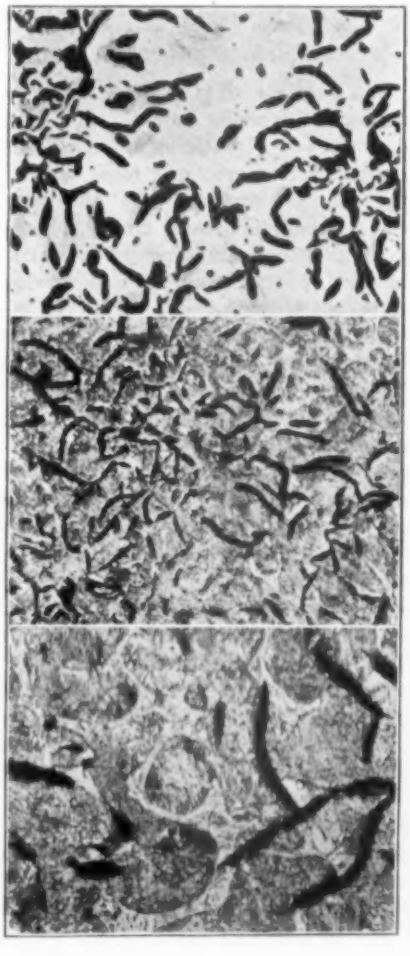
1. Refining molten cast iron from the cupola.
2. Refining in the cupola during the melting process.

The first method is said to remove 40 to 60 per cent of the sulphur in molten cast iron for pouring heavy work and 20 to 30 per cent for light castings. With the proper equipment this is accomplished without chilling the metal sufficiently to cause pouring difficulties. Coincidently, slag, oxides and other impurities in the metal are reduced materially. The equipment required is simple and inexpensive as will be described. This

Decreases Sulphur

SULPHUR in scrap iron gradually increases from year to year. Several expedients have been tried to remove or lower the sulphur, among which are the alkalies. This article which was abstracted from a paper read before the Detroit Foundrymen's association by George S. Evans, gives the details of the operation and some of the results obtained in using an alkali flux in melting foundry iron. Mr. Evans is metallurgist with the Mathieson Alkali Works Inc., New York.





Photomicrographs of machinery cast iron. Fig. 4—Iron as melted. Fig. 5—Appearance after refining. Upper, as polished; center, etched; and lower, etched and higher magnification

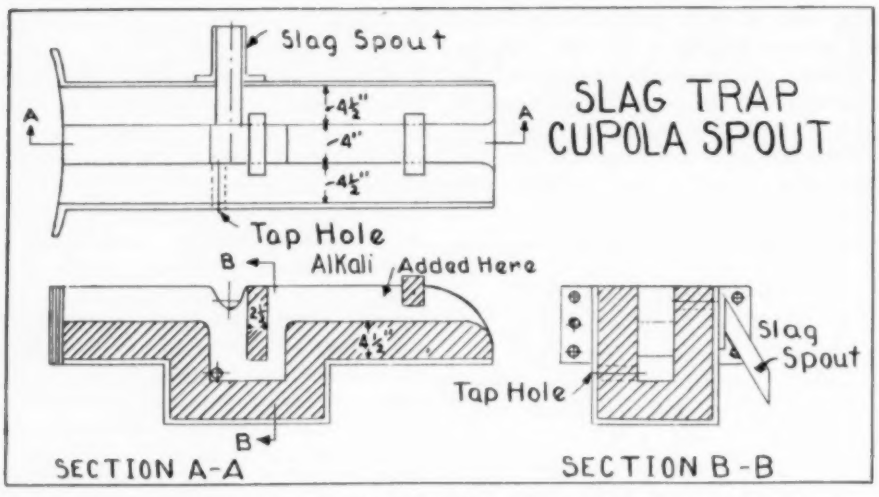


FIG. 6—DRAWING SHOWING SOME DETAILS OF SLAG TRAP CUPOLA SPOUT

method is used regularly in foundries throughout the United States and Canada, making various classes of castings. The process and flux which were developed by the Mathieson Alkali Works, New York, is described as follows: The refining is accomplished in an ordinary teapot reservoir ladle as illustrated in Fig. 1. This usually has a working capacity equivalent to one-third of the cupola melting rate per hour and is maintained about one-half full at all times. Later developments include the use of one or the other of the stationary forehearths illustrated in Figs. 2 and 3 and teapot crane ladles.

Maintain Uniform Bath

The success of the process in all instances depends upon the maintenance of a bath of the alkaline reagent of more or less uniform strength in contact with the metal for a predetermined time. This is accomplished by making periodical additions of the reagent and periodically withdrawing a portion of the spent slag. This results in uniform reactions between the elements in the molten iron and the reagent resulting in the delivery of uniform metal for pouring. In addition, this system of regulation gives the maximum refining per unit of the refining reagent. A slag trap often is arranged in the cupola spout which provides for continuous flow of the molten iron from the cupola as melted, with separation of the cupola slag from the iron before it reaches the ladle. Construction of the slag trap spout is illustrated in Fig. 6.

Although not essential to the proper functioning of the refining process, continuous flow of the metal makes possible a close adjustment of the alkaline reagent charge to the metal melted, simply by timing the additions, and results in more uniform reactions. Continuous removal of the molten iron from the cupola as melted represents good cupola practice and generally produces better melting conditions with cleaner iron. The ladle serves both as a mixing and refining reservoir and results in more uniform pouring temperatures and composition than where intermittent tapping is followed.

Method of Operation

The cupola taphole is stopped up at the start as with regular practice and the usual quantity of iron allowed to accumulate before making the first tap. The tapping hole is then left open for the remainder of the heat, except in case of an interruption, when it may be closed temporarily. No difficulty is experienced in keeping the taphole open throughout the heat. The alkali is added after the metal has risen in the ladle sufficiently to completely seal up the opening into the ladle spout. The first addition of the reagent is usually three to five times the quantity to be used per ton thereafter or sufficient to give a good layer of the fused reagent over the surface of the metal. By the time the reservoir is filled, the reaction which is more rapid at the start due to the concentration of the bath, has been completed and the metal is ready for pouring. Subsequent additions are then made at regular intervals throughout the remainder of the heat, as required to maintain proper concentration of the reagent bath and give the extent of refining desired.

The refined iron is drawn from the bottom of the ladle through the teapot spout as required and without particular regard to the refining process. Where the heat is of only a few hours duration the spent slag may be allowed to build up in the reservoir throughout the day. With long heats a portion of the slag usually is poured off from time to time by tilting the ladle backwards.

The forehearth for continuous flow of the refined iron as shown in Fig. 2, is adapted for light work where hot metal is essential for running the light sections. This generally has a bath

Table I

Analyses of Irons as Melted and Refined

Machinery Cast Iron

	As melted	Refined
Silicon	1.78	1.75
Manganese	0.43	0.39
Total carbon	3.18	3.16
Combined carbon	0.65	0.60
Phosphorus	0.63	0.63
Sulphur	0.143	0.092
Brinell hardness	243	226

Results of Tests Made With Different Mixtures

	Per cent Silicon	Per cent Manganese	Per cent Sulphur	Per cent Sulphur reduction
1—Stove Plate				
As melted	2.78	0.53	0.102	
Refined	2.61	0.51	0.069	33
2—Machinery				
As melted	1.77	0.42	0.078	
Refined	1.63	0.39	0.049	37
3—Semi Steel				
As melted	1.39	0.73	0.069	
Refined	1.33	0.68	0.047	32
4—Brake Shoe				
As melted	1.05	0.34	0.105	
Refined	1.04	0.39	0.054	49
5—Chilled Iron				
As melted	0.71	0.69	0.198	
Wheels, refined	0.66	0.67	0.122	38
6—Steel Remelt				
As melted	0.29	0.11	0.094	
Refined	0.28	0.19	0.054	42

capacity of one-sixth of the cupola melting-rate per hour and is constructed to reduce loss of heat by radiation to a minimum. It is necessary that means for preheating be provided and the forehearth well heated up before the start to avoid cold first iron. The forehearth shown in Fig. 3, is designed to utilize waste gases from the cupola stack for superheating the bath in the reservoir.

For extra heavy classes of work, the refining is sometimes accomplished in a crane ladle equipped with teapot spout. One or the other of the equipment illustrated usually may be adapted to the operations of the average foundry. In many instances a teapot spout has been added on to the old mixing reservoir ladle during the week end shut down. With the installation of any of the foregoing equipment the refining becomes a matter of adding the refining reagent. Any of the alkalies tend to corrode the ladle lining. However, the cutting is nominal and will add less than one cent per ton of metal treated to ladle refractory casts.

The refining is equally practical with any of the foregoing equipment and is not accompanied with any slag handling difficulties. Molten iron for special castings may be refined by individual ladle treatment with the alkalies. The extent of sulphur removal will vary with the kind and quantity of alkali used, temperature of the metal and time allowed for the reaction. In this process the reagent usually is added to the ladle before making the first tap or it is added in two portions, the second lot going in after the ladle is one half full.

When the molten iron comes into contact with the alkali, a violent reaction is set up. This is followed by a boiling action that continues for sev eral minutes and then gradually subsides, indicating that the reaction is completed.

The time required for the reaction is from five to 15 minutes. After the boiling action has subsided coke breeze, sand or slaked lime dust is added to thicken up the slag which facilitates skimming. The alkali slag formed is fluid and highly active. Any going into the mold with the iron will attack the sand and cause a slag spot, possibly resulting in the rejection of the casting. Therefore it is necessary that extreme care is taken to insure complete removal of the alkaline slag before pouring.

Individual ladle treatment is impractical for refining cast iron in the average foundry owing to the slag difficulties resulting. However, it generally is used in steel converter shops for desulphurizing the metal before blowing in the converter. Small quantities of slags going into the converter will be neutralized or blown out with the start of the blow and do not interfere with the operations.

Upon application of the refining process for desulphurizing to regular plant operations at the Griffin Wheel Co., other benefits resulting from its use later proved to be of greater importance than the actual removal of sulphur. Test pieces taken throughout the heat showed greater uniformity both in depth of chill and analysis. Finished wheels showed more uniform shrinkage, higher average strength and operating losses chargeable to metal conditions were reduced by approximately 50 per cent during the first year of operations with the process. Tests of refined iron showed that suspended impurities such as oxides of iron, entrained slag particles and occluded gases which tend to produce defective wheels were appreciably reduced by the refining. Transverse tests of refined iron showed higher strength with uniformly greater deflection.

The usual effect of the refining upon the composition of cast iron is about as follows: The percentage content of total carbon is unaffected. Combined carbon is slightly lowered, varying with the character of the metal and extent of the sulphur reduction and graphite carbon proportionately increased. Phosphorus also is reduced slightly. Sulphur is reduced in proportion to the quantity of the reagent added per ton of molten iron refined, other conditions remaining the same. Silicon and manganese usually show a slight decrease in the refined iron upon analysis, the amounts depending upon the extent of the treatment and character of the iron. Dirty irons show relatively greater reductions.

The analysis given in Table I, of cast iron as melted and after refining show some of the possibilities afforded by use of proper refining methods.

Refined iron is more fluid, due both to the removal of sulphur and to thorough deoxidation, and removal of slag inclusions which tends to produce sluggish iron. This was proved by pouring wedge shape castings, three inches wide and graduating from ¼ to 1/64 inch in 18 inches, from metal taken from the cupola spout and from the refining forehearth after refining. Test bars from refined iron generally will show higher average tensile and transverse strength and consistently better elongation or deflection on bars of equal transverse strength. Although of generally closer structure, properly refined iron shows softer under the brinell test and is readily machinable.

The general effect of the refining upon the strength and hardness of cast iron, including the two extremes, car wheel metal and stove plate iron, is given in Table II. Examination of the broken fractures of a series of test bars made from wheel iron as melted and from the refined metal showed defects either of pin holes or slag inclusions visible to the eye in 48 per cent of the bars cast from iron taken at the cupola spout as against 16 per cent in the bars from refined metal. Studied under the microscope specimens from refined metal show more uniform structure throughout the section and a reduction in minute inclusions of occluded slag particles or oxides. These differences readily can be seen, even by the layman, in the microphotographs of cast iron, illustrated in Fig. 5.

In the microphotographs, the white area represents a matrix of pearlitic iron in which combined carbon is dissolved and free iron; the black areas are graphitic carbon and the grayish specks are mostly occluded oxides of iron and minute slag inclusions. In the etched specimens, at higher magnifications, the pearlitic structure is brought out and the im-

(*Concluded on Page* 187)

Table II

Two Extremes in Cast Iron Compared

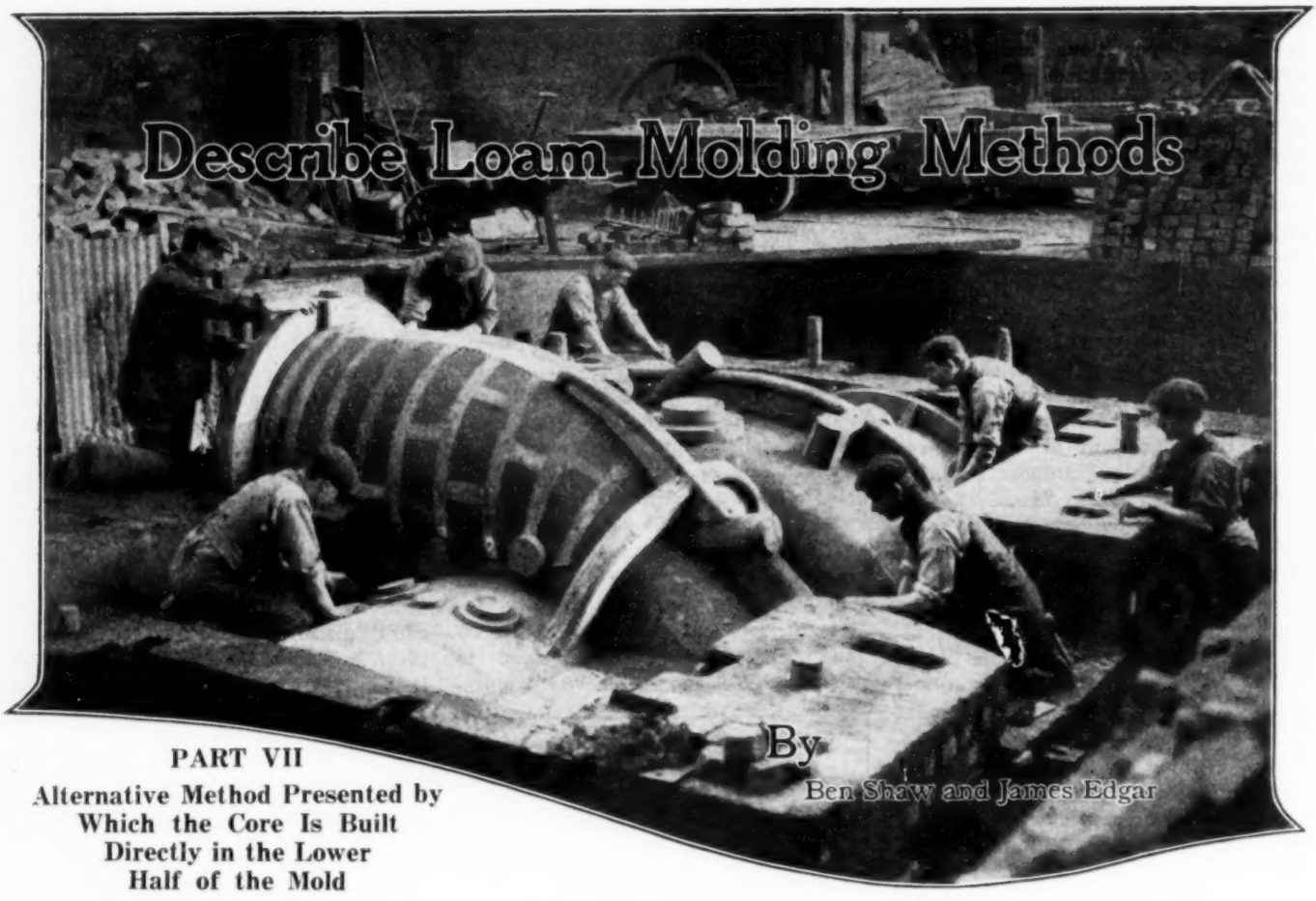
Car Wheel Iron

Transverse strength, as melted	4,360 pounds
Pounds per square inch, refined	4,410 pounds
Tensile strength, as melted	31,843 pounds
Ultimate pounds, per square inch, refined	32,437 pounds
Hardness, brinell number, as melted	147
Refined	136
Deflection, as melted	0.189 inches
Refined	0.214 inches

Stove Plate

Transverse, as melted	2,750	Hardness	231
Strength, pounds per square inch, refined	2,780	Hardness	218

Describe Loam Molding Methods



By
Ben Shaw and James Edgar

PART VII

Alternative Method Presented by Which the Core Is Built Directly in the Lower Half of the Mold

ALTHOUGH horizontal spindles usually are employed in making cores and are used to a limited extent in making temporary patterns, they also are employed in making the molds for several classes of castings, for example rolls and large pipe. This feature of the process is not appreciated at its true value by many foundrymen, even by loam molders whose experience may have been limited. The method is not economical for an odd job unless special facilities are available for adopting it. Where a number of large cylindrical castings are required the method undoubtedly is worthy of consideration.

While the principle of sweeping a mold is similar to that underlying the sweeping of a core, the method of application varies considerably. In sweeping a core or a loam pattern with the aid of a horizontal spindle the sweep or strike is held stationary on suitable supports. It occupies the same relative position as a tool in a lathe. The rotating core covered with soft loam is brought to the correct size and shape gradually in its continuous journey past the board. Where the method is employed to form the mold proper, this procedure is reversed. The spindle and sweep revolve while the mold remains stationary in the floor or flask.

Special box parts are required which are provided with bearings at the ends to accomodate the spindle. Expense of preparing these special boxes usually constitutes the principal objection to employing a horizontal spindle for sweeping molds for cylindrical castings that are long in comparison to their diameter. Suitable box parts cover a wide range on this class of work and would reduce other costs materially, if the general character of the type of castings for which they are suitable can be anticipated to any reasonable extent.

Among the many varieties of castings adaptable to this class of molding, cast iron retorts for gas and chemical works and iron and steel rolls readily come to mind. Diameters and lengths of these castings vary somewhat. Even though a considerable number of one size is required, a wood pattern does not necessarily cheapen production since almost invariably the molds are made in dry sand. Substantial box equipment is required and the time and labor involved amount to the same as where the mold is swept in loam. With sand a complete mold must be made for each casting. Once a loam mold is made it will serve for many castings by simply renewing the loam facing each time after removing the casting.

Longitudinal section of a retort which simply is a straight piece of pipe with a flange at each end is shown in Fig. 59. It is 9 feet long, 2 feet in diameter with a metal thickness of 1 1/8 inches. In many instances the bolt holes are cored in the flanges to reduce the cost of machining, but since this is only a trifling detail, whether the holes are cored or not, we shall assume for the purpose of illustration that the flanges in this instance are cast solid.

Pattern parts for the mold include the sweep shown in Fig. 62 and four half flanges shown in Fig. 60. The inside diameter of the flanges is made to the bore size of the pipe and the sweep is checked at each end to form the core prints. The distance between the checks corresponds to the length of the pipe between the flanges. Sometimes the sweep is employed as a guide in setting the flanges. After the flanges are located properly and fastened temporarily in place, about 1/8-inch is cut from each shoulder on the sweep to provide clearance when in use later. Convenient size pieces of wood are half lapped to the sweep and butted against the spindle. In the original layout these pieces are equal in length to the radius of the required mold. Before the sweep is attached to the spindle, a short piece, correspond-

ing to half the diameter of the spindle, is cut from the end of each piece.

A typical box part suitable for making the mold is shown in Fig. 63. In many instances the ordinary pipe boxes are used. The ends with semicircular openings are bolted to the sides. The bearing for the spindle is bolted to each end across this semicircular opening. In the box shown in Fig. 63 the same style ends may be used, but the bearings are adjustable and may be set up at any points in the box to suit castings of varying lengths. These bearings must be adjusted so that each pair will form a true circle at each end when the two parts of the mold are assembled. The two halves of the mold are swept independently and therefore the accurate setting of the spindle and sweep in each half is a matter of importance.

Boxes Made In Sections

One of these boxes may be cast as a unit or made up of sections bolted together. The practice depends on personal preference and local conditions. They may vary somewhat in design or in detail of construction, but in general principle they correspond to the box part shown in Fig. 63. Although not shown in the illustration, these boxes are equipped with the usual devices for lifting them and turning them over if necessary. A 3-inch diameter spindle will be found rigid enough for all ordinary purposes, therefore the bearings and caps may be assembled and machined to this size.

General arrangement of the mold, flanges, sweep and spindle is shown in Fig. 64. Two spiders and two collars are placed on the spindle and adjusted at suitable distance from each other before the caps on the bearings are bolted down. The edge of the sweep is checked for distance from the spindle before it is bolted to the spiders. With everything set, the brick is built on the bottom of the box until it approaches a point at each end where it will serve for a bearing for each of the half flanges. With the check on the sweep for a guide, no difficulty is experienced in locating the half flange accurately. After the flanges are set the remainder of the mold is bricked to shape.

Some molders prefer to build the second half of the mold before applying the loam facing to the first half. This practice is to be commended since it allows the bricks in the first half time to absorb moisture. When the facing loam finally is applied it adheres firmly. The bricks in the second half absorb moisture while the molder is applying the loam and finishing the first half.

Shifting The Spindle

The spindle and sweep may be moved readily from one box part to the other as many times as may be required. Reasonable care is taken to prevent any movement in the collars and spiders. The caps are removed from the bearings on one half of the mold and placed on the bearings in the second mold after the spindle and sweep have been lifted from the first and placed in the second.

Obviously it is necessary to locate the spindle in such a manner that the two half molds will coincide when they are assembled. The ends should be marked in a suitable manner to prevent any possibility of placing the cope on the nowel end for end.

After the face of the mold has been swept in each half the joint is strickled flush with the edges of the box. Where the joint of the box is uneven, it is customary to strike the joint from the horizontal top edges of the end bearings. During the process of building the mold provision is made suitable for runners. Their location will be determined by the position the mold is to assume during the pouring period. If the mold is to be poured while in a horizontal position the gates are formed in the joint. The metal enters through runners in the top part and a riser is placed on top of each flange. Occasionally castings of this kind are poured while the mold is supported at an angle that may vary between 10 and 30 degrees from the horizontal. Custom varies in different foundries and the casting may be poured either from the low or the high end. In either case a flow-off usually is arranged above the flange on the high end. If the metal shows any sign of fluttering a small quantity is run through this flow-off.

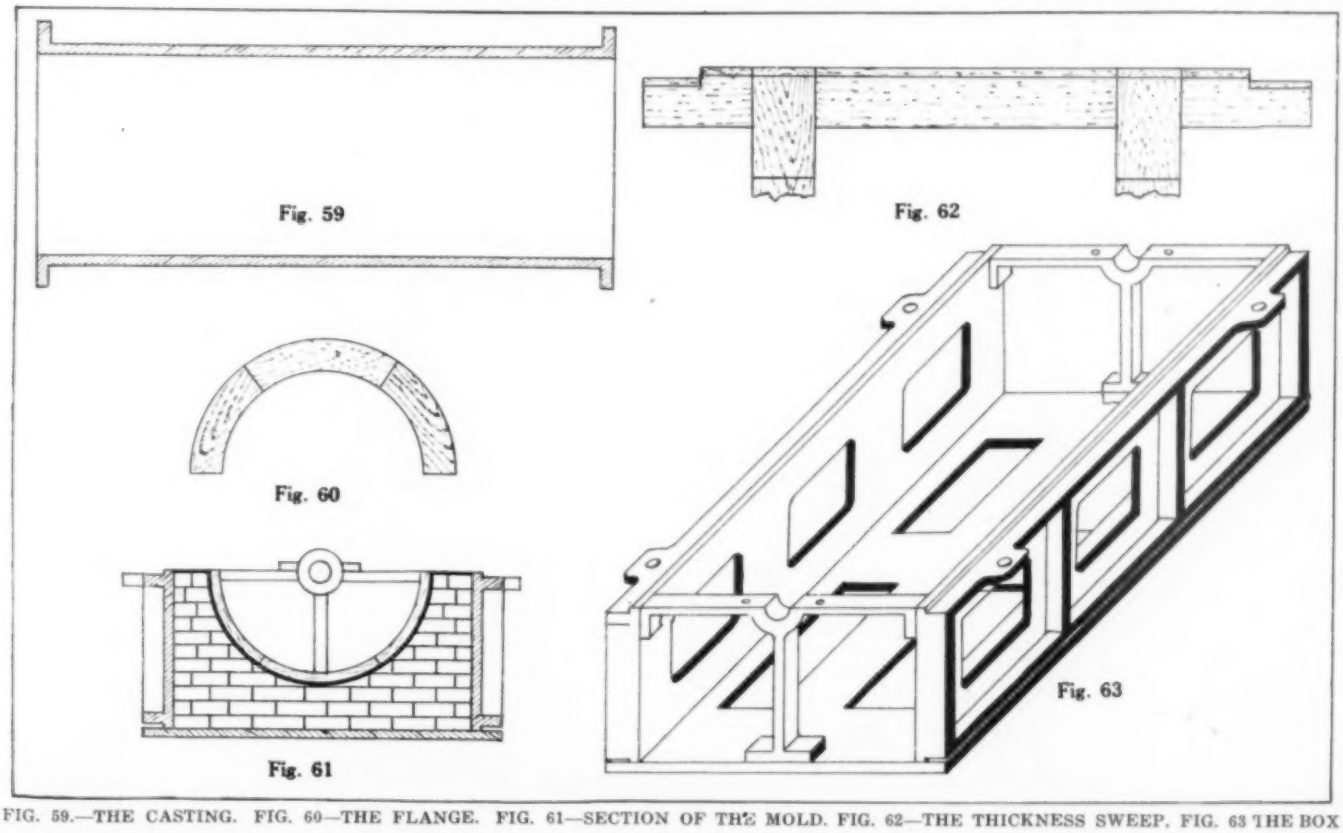


FIG. 59.—THE CASTING. FIG. 60—THE FLANGE. FIG. 61—SECTION OF THE MOLD. FIG. 62—THE THICKNESS SWEEP. FIG. 63 THE BOX

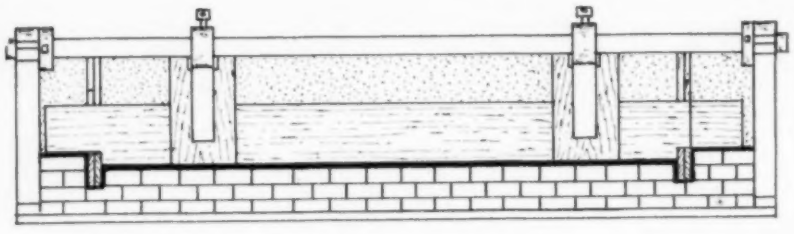


Fig. 64

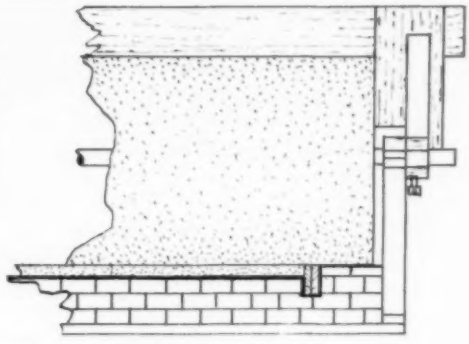


Fig. 66

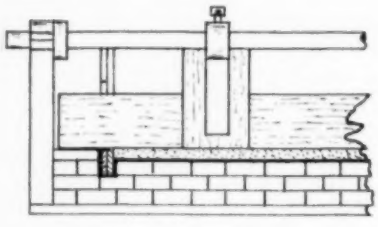


Fig. 65

Figs. 64, 65 and 66—Application of sweeps in laying the thickness and forming the core. Fig. 67—Section of the mold with completed core

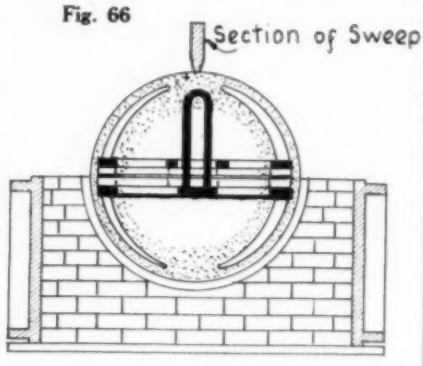


Fig. 67

Like many other habits in a foundry this trick of flowing metal through the risers frequently is carried to excess. It is like an epidemic. Shortly after it has been tried on one job every man in the shop will be found flowing iron through his risers.

Adjust The Sweep

A sectional view of half of the finished mold is shown in Fig. 61 where it will be noted the flange projects above the face of the mold. The flanges are removed at this stage if the core is to be built independently. They are left in place if the core is to be built in the mold.

In some foundries the practice of building the core directly in the mold is quite common. In others, circumstances occasionally force its adoption. The method reduces the working space necessary, an important consideration in busy periods when floor space is at a premium. In some foundries no facilities are available for sweeping a large core on a barrel and then the only alternative method is to build the core in the mold.

Methods of applying a thickness to the face of the mold so that it may serve for a corebox have been described in Part V of the present series which was published in the Feb. 1 issue of THE FOUNDRY. Under certain conditions the most convenient and economical method is to lay a covering of narrow wood staves, the thickness of the required casting, over the face of the mold and build the core against the wood, the upper part of the core to be formed with a sweep. However, the usual practice is to sweep a thickness of loam on the face of the mold, allow the loam to stiffen and then build the core. A straight sweep adjusted flush with the surface of the core prints at the ends will smooth the thickness of loam to form a temporary corebox. Detail of sweep construction and application is shown in Fig. 65.

A second sweep is required to form the top half of the core. Since in all probability the core is to occupy all the space out to the ends of the box, the braces by which the sweep is attached to the spindle must be fastened at a point outside the end. The spiders are fastened to the spindle in such a manner that they touch the bearings and thus dispense with the collars usually employed to keep the sweep in the proper position longitudinally. Method of adjusting the sweep is shown in Fig. 66.

Build The Core

After the sweep has been set properly to coincide with the inside edge of the loam thickness in the mold, both spindle and sweep are removed temporarily and are not replaced until after the core has been built as high as the joint line on the mold. With the spindle out of the way a substantial thickness of loam is spread over the face of the temporary corebox and a cast iron grid provided with long curved horns is pressed down into the loam. The upper face of the grid is rapped down a sufficient distance below the joint to insure clearance for the spindle.

Two grids are required for the entire core, one for the top half and one for the bottom half. The lower grid is provided with suitable staples for lifting the core out of and into the mold. These staples extend upward to within a few inches of the top of the core and the legs are spread a sufficient distance to clear the spindle. In some instances the staples are set in line with the sides of the core but in staggered formation near the center line to clear the spindle. By arranging them at a slight slant the tops of the staples are brought into a straight line along the top and the slight deviation from the center line near the center does not affect the accurate lifting of the core. Pieces of iron packing are placed between the lower and upper grids to prevent any sag and accompanying nipping of the spindle.

Following the bedding of the first grid into the loam, additional loam is applied to form a thickness of 3 or 4 inches. It is advisable to work a considerable amount of broken pieces of dried loam into the mixture as the work progresses. This will stiffen the loam, facilitate the drying and prevent it from sagging.

Core Filled With Ashes

The loam shell is filled with ashes introduced through the grid before the spindle is placed in position. The core sweep is attached to the spindle and adjusted properly before the upper grid is located. The sweep is

ACETYLENE AND OXYGEN CYLINDERS

SAFE PRACTICE IN STORAGE, CARE AND HANDLING

(*Continued from Data Sheet No.* 610)

GENERAL SAFETY RECOMMENDATIONS

Use No Oil. Never allow oil or grease of any kind to come in contact with oxygen. It is dangerous and lubrication of apparatus is not necessary.

Every week disconnect the blowpipe and blow out both hose lines. It is important that the inside of the hose is clean so that dirt or small particles of rubber will not be carried into and clog the blowpipe.

Always see that hose is clamped securely to the blowpipe and regulators before using.

Do not attempt to repair hose with tape.

All hose should be examined carefully at least once every week for leaks, worn places and loose connections. This can be done by immersing the hose in water when under pressure. It is good practice, about every two months, to cut off the hose at each end about two inches back of the connection and reinsert connections securely.

Should a backfire occur and reach the hose, discard that length of hose. A backfire of this sort renders a piece of hose unsafe, because it burns the inner walls. Sooner or later this part of the hose will disintegrate and cause trouble by clogging or otherwise interfering with proper operation of the blowpipe.

When a new cylinder is connected to apparatus, always open the cylinder valve, the blowpipe valve and regulator for a short time to expel any air from the hose before lighting the blowpipe.

Always protect hose from being trampled on or run over. Avoid tangles and kinks. Do not leave the hose so it can be tripped over and a connection pulled off, or worse still, the cylinders and equipment knocked over.

Protect the hose from flying sparks and open flame.

New hose is dusted on the inside with fine talc. Blow this dust out before use.

Do not allow the hose to lie in pools of oil or grease because these will penetrate rubber.

Do not hang a blowpipe with its hose on regulators or cylinder valves.

Be sure that space between cylinders and the job is clear so that valves can be reached quickly in case of emergency.

When working in a confined space, always have a helper present to close the cylinder valves or help in other cases of emergency. Test all equipment for leaks before taking it into such places, and bring it out with you when work is interrupted.

When working in a confined space, be sure of proper and adequate ventilation, by natural means or by an air fan or blower. Never feed oxygen from a cylinder into a confined space. It is unsafe to do so. Welding in confined spaces is a job requiring special precautions. The welder should wear special clothing—preferably fireproofed, but certainly of wool. A helper should always be nearby to render help in emergencies.

Always use the proper tip or nozzle and the proper pressure for the work involved, as shown on the apparatus manufacturer's pressure chart.

In case of a backfire, immediately close the blowpipe oxygen needle valve for a moment. Then reopen and relight if necessary. If the end of the tip comes in contact

(*Concluded on Data Sheet No.* 612)

ACETYLENE AND OXYGEN CYLINDERS

SAFE PRACTICE IN STORAGE, CARE AND HANDLING

(*Concluded from Data Sheet No.* 611)

with the molten metal, there sometimes occurs a backfire that extinguishes the flame. Other causes of backfire are dirt on the welding head sets, or loose welding heads or tips. The latter can be overcome by cleaning seats and tightening welding heads and tips.

When a new cylinder is connected to the apparatus, open the blowpipe valves a sufficient length of time to expel any air from the hose before lighting.

When the welding is to be stopped for a short time, release the pressure adjusting handles of the regulators by turning them to the left. When the welding is stopped for a longer period (over night or during lunch hour), close the cylinder valves and release all gas pressure from the regulators by opening the blowpipe valves momentarily.

When a new cylinder is connected to the apparatus, do not light the blowpipe until positive the regulator is adjusted to the proper working pressure.

Always wear good welding goggles when working with a lighted blowpipe. Do not use cheap substitutes.

Never attempt to weld a jacketed vessel, tank or container until after every possible precaution has been taken to vent the confined air sufficiently. A metal which is suspiciously light is hollow inside, and should be drilled before heating. If the vessel has been used for gases or combustible liquid, either clean all traces of these by steaming or else weld while full of water.

Do not cut material in such a position as will permit the cut section to fall on the legs or feet.

When welding or cutting is being performed in buildings provided with wood floors, protect the floors from sparks and hot metal by an adequate covering of brick and sand. Have a fire extinguisher handy.

Dusty and gassy atmospheres in certain mines, mills and industrial plants require extra precautions to avoid explosions or fires from electric sparks, matches and open fires. Welding should therefore be done in such suspicious places only when proper precautions have been taken and after instructions to go ahead have been given by the responsible official in charge.

Use a friction lighter to light a blowpipe. Do not use a match. The hand may be burned.

None but trained or otherwise qualified men should be permitted to use oxy-acetylene apparatus.

Never use free acetylene gas at more than 15 lb. pressure nor under any conditions compress free acetylene to more than this pressure.

Do not experiment with, try to improve or change regulators or blowpipes in any way.

Welding on brass or bronze should be conducted in well ventilated locations and operators should be supplied with suitable respirators if the welding work is continuous.

All those who operate acetylene generators, acetylene piping installations or oxygen manifold systems should be examined and adjudged competent by their superiors for this important work. Printed rules and instructions on the care, maintenance and handling of acetylene generators as supplied by the manufacturer must be followed carefully.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

THE FOUNDRY DATA SHEET, MARCH 1, 1926

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Around the World with The Foundry

Little Journeys to the homes of our readers

Norway

LOVE for a sea faring life is a natural heritage of the descendants of the fierce old Vikings who raided and harried every maritime nation in Europe in the period between the 7th and the 12th centuries. In these later days as captain, or mate, or able seaman engaged in legitimate commerce, they worthily uphold the best traditions of their chosen calling. They have driven the windjammers with their clouds of billowing white canvas and later, the big, bluff iron tramps, into every port on the seven seas. Crossing the western ocean in a smother of foam and spray, with the lee rail under, or with the big seas pouring in over the bows and boiling aft over the battened hatches, means little to the men whose ancestors in the 10th century, made the same voyage in open boats and coasted along the Atlantic seaboard from Labrador to the Virginia capes.

Owing to its geographical position, Norway is not a great manufacturing nation, but her foundries are up to date and turn out castings practically of every description. Authoritative information on technical and practical development in the foundry industry is presented to the executives of 15 of the 28 casting plants in the country twice a month through the columns of THE FOUNDRY.

"Wherever metals are cast you'll find THE FOUNDRY"

swung from one side to the other to make sure of suitable clearance between the edge and any projecting points on the upper grid.

Building the second half of the core is resumed after the sweep has been adjusted and after the two grids or core arbors have been bolted or clamped together. The core gradually is built toward the top with loam on the outside and ashes on the inside. Only a rough form is aimed for the first time and the loam is worked as stiff as possible to reduce the tendency to sag. The core is allowed to settle and stiffen before the finishing coat is applied. The position of the staples is marked on top of the core and suitable openings are cut away around them while the loam is green. A coating of thin loam swept over the surface of a fairly stiff core will impart a smooth finish. The final application of the sweep is deferred until any danger of sagging is past. However, care must be observed in transporting the core to the oven. Rough handling will cause the core to sag and change the contour from that of a true circle.

After the mold and core are dried the core may be lifted from the mold and placed on suitable supports while the bottom half of the mold is prepared for its final reception. The thickness material is removed from the face of the mold and the half flanges are removed from the ends. After a certain amount of hand finishing the face is black washed.

All loam molds develop cracks during the drying process. The extent of the defacement depends on the strength of the loam, that is on the clay content. A coarse, open loam will crack but little, while a strong, clayey loam will crack wide open in many places. Where these cracks are not filled properly they cause buckles or dumb scabs on the face of the mold in the vicinity. The cracks should be cleaned, swabbed with thin claywash and filled with loam rubbed against the sides with the fingers.

When mold and core are blacked and finally dried, arrangements may be made for assembling them preparatory to filling the mold with metal. While the foregoing method of making the core frequently is adopted, it cannot compare either in speed or economy with the method described in a previous article where the core is swept on a perforated barrel.

Steel production of the Pittsburgh district amounts to 11,500,000 tons per annum, equal to 26 per cent of the country's total. About 112,000 persons are employed in this field.

Pittsburgh Foundrymen Discuss Costs

The illustrated address of E. T. Runge of Cleveland, cost accountant of the National Founders' association, delivered before the Pittsburgh Foundrymen's association at the February dinner and meeting held Monday evening, Feb. 15 at the Fort Pitt hotel, Pittsburgh, made it one of the most interesting gatherings held by that organization in many months. Approximately 110 members and guests were in attendance.

Mr. Runge stated that the proper way to figure costs on castings is to figure the price of the mold, the melting cost, the cleaning cost, and last but not least, the core cost. As an experiment and at the same time a demonstration of the need of uniform cost accounting in foundries, he asked the foundrymen present to figure the cost of an imaginary casting weighing one pound, considering pig iron at $22 per ton, coke at $10 per ton, and various other items in accordance therewith. The results were astonishing in that the estimates varied all the way from 5c to 12c. He gave, by means of blackboard drawings, figures, etc., various methods of serving the problem of foundry cost accounting.

Before Mr. Runge's address, L. A. Hartley, director of education of the National Founders' association, gave a short talk on what that body expects to do in the way of assisting foundrymen to obtain apprentices. He is visiting a few Pittsburgh plants, not merely to suggest the use of apprentices but how to go about obtaining them. Through close co-operation with boards of education in every city, foundry apprentices are to be more plentiful in the future.

Can Sand Be Reclaimed

(*Concluded from Page* 172)

for renewing their sand heaps than the orthodox method of adding a quantity of new sand daily.

This series of articles will be written in plain and so far as possible, non-technical language and is designed primarily for the information of the vast army of plain foundrymen who have not had the time, the inclination, the opportunity or the preliminary training required to understand or assimilate the vast amount of literature that has been published on the subject of sand old and new.

For the benefit of those foundrymen who through curiosity or scientific interest, want to examine or scientific over records of sand investigation up to the present, attention is directed to THE FOUNDRY which for many years has published an average of three extensive papers every year on some phase of the subject in addition to many short references.

Work of the various sand research committees has received comment and review and this includes work done in foreign countries in addition to that done by the bureau of standards and by the American Foundrymen's association. Extent to which the combined question of sand testing, reclamation and conservation has engaged the attention of foundrymen may be inferred from the fact that the American Foundrymen's association issued the *Transactions* for 1924, Vol. XXXII in two volumes. One of these of 400 pages was devoted entirely to the papers and discussions on sand presented before the Milwaukee convention of the association. A bibliography of the principal articles on sand that have appeared in the technical press of the world for the past 10 years has been issued by Whitehead Bros., Providence, R. I. Any person who wants to study the subject thoroughly and read the thousands of pages of material that have been published on the subject of sand, and who does not own or has not access to a complete file of the various publications, may consult bound volumes of THE FOUNDRY or the *Transactions* of the American Foundrymen's association in the public libraries of the principal cities. Equipment required to carry on the tests recommended by the American Foundrymen's association may be ordered through Dr. H. Ries, Cornell university, Ithaca, N. Y. who is chairman of the joint committee on molding sand research.

This is the first of six articles by Mr. Dwyer on the general sand situation in the foundry. The second dealing with varieties of sand, lack of definite standards and the practice in a car wheel foundry where clay is used instead of sand will appear in an early issue.

The Editors.

Refine Iron With Alkali

(*Concluded from Page* 183)

provements in structure resulting from the refining is noticeable. The proper refining of cast iron with the alkalies produces a cleaner and more uniform metal with superior chemical and physical properties. This results in a reduction of shop losses chargeable to metal impurities.

The refining tends to close up the grain of cast iron and improves machining qualities. The former is due to a breaking up of the graphite crystals and the latter to a removal of silicates and other slag inclusions which tend to dull the cutting tool.

How and Why in Brass Founding

By Charles Vickers

Propellers Are Dirty

We make boat propellers weighing from 5 to 60 pounds and have difficulty getting clean castings as the metal seems to dross badly although we pour through a horn gate to the bottom of the hub and place a heavy riser on top. We use an alloy consisting of copper 60 pounds, zinc 40 pounds, 30 per cent manganese copper 2 pounds, Swedish iron 1 pound and aluminum ½ pound. We have made slight changes in the mixture without getting better results. We put the iron and manganese copper in with the copper and melt, then add zinc and finally aluminum. We would like to know of a better and cleaner running alloy.

The dross difficulty is due to the method of gating as a horn gate is not suitable for such an alloy as manganese bronze, because the alloy contains aluminum and as a consequence must not be agitated as it flows into the mold. The effect of aluminum on all metals and alloys is similar to that of soap on warm water; it producers a lather, which in the case of the metal is dross. Wherever two streams of molten manganese bronze impinge, lather is produced. Should the steam strike a core and be thrown back there will be a lather. A horn gate is like a hose nozzle; it gives force to the emerging stream of liquid. This is ideal for producing lather as the stream is thrown upwards to fall back again forming a beautiful lather which is then washed into the blades until it is jammed between the cope and drag surfaces of the mold. There it stops because it has to, and shows up on the castings.

It is a simple matter to overcome this difficulty. If it is thought advisable to pour from the hub bring the metal down below the same then cause it to rise straight upwards through three, or more round pencil gates distributed at intervals about the hub thickness, or a channel can lead from the sprue to a ring gate round the bottom of the hub, from which gates are cut into the hub into the bottom thickness, but not into the sides. It may be necessary to use cover cores as the gate has to be made during the ramming of the drag, but this is a mere detail of molding. Propellers several feet across are frequently gated into the blades. As the drossing is not the fault of the alloy, there is no need to change the formula provided it has proved satisfactory. It would be an improvement though to use sheet iron in the shape of tin plate clippings loosely coiled, and add them to the copper after it is melted. Stir this iron in quickly, then add the aluminum, and heat; add the zinc last.

Adds Excess Deoxidizer

We have had considerable difficulty making a bronze water-cooled valve seat shaped like a ring, and 5 feet in diameter and having finished walls ⅝ inch thick. The water circulates inside the ring at a pressure of 50 pounds per square inch, and the castings invariably sweat at this pressure. The alloy we are using is copper 90 per cent; tin 6 per cent; zinc 2 per cent, and lead 2 per cent. We melt in a noncrucible oil-fired furnace and pour from ladles, two up with one riser, and the cope is well vented. The casting usually looks good but it is not impervious to water and for that reason is rejected. A flux of borax and lime is used on the metal while it is being melted and as a deoxidizer one per cent of a 15 per cent phosphor copper is added after the metal which consists of virgin metals is melted.

The difficulty in this case is caused by the addition of too much phosphor copper. The fractured surfaces of such an alloy will usually show there is something wrong as they will not show homogeneous metal Too much deoxidizer, no matter what is may be is always worse than no deoxidizer at all in the case of alloys consisting of copper, tin, zinc and lead, because by over-stepping the limits the metal is disturbed and becomes unhomogeneous. Observe the fracture of a casting.

The alloy would be improved greatly by the addition of a little nickel, about one per cent, added as one of the densifying alloys now found on the market, which carry sufficient appropriate *deoxidizer*, and supplants some of the tin content. The maximum amount of phosphorus will be represented by 2 ounces of the 15 per cent phosphor copper per hundred pounds of metal.

Remove Iron in Turnings

We would like to learn if small amounts of cast iron and steel are injurious to bearing bronzes such as the alloy copper 77 per cent; tin 10 per cent; lead 10 per cent, and zinc 3 per cent. The iron is introduced by the returned turnings and also from the melting of iron stirrers. The castings are sometimes black externally as they come from the sand, but aside from this we wonder if the iron has any bad influence.

A small amount of iron will do no harm provided it is chemically combined with the bronze. This is not likely to be the case when the iron is introduced as cast iron or as steel because it then contains carbon which renders it insoluble in copper and its alloys and the iron segregates as little droplets which are exceedingly hard as some tin is also taken up. After the metal has solidified the little droplets of iron are found scattered throughout the casting like currants in a cake, and in machining the bronze these nodules of iron ruin the tools.

The iron should be removed from the turnings before they are melted. A magnetic machine is best, but before such machines were known, steel magnets were used, and these can be used in cases where the amount of such turnings is not sufficient to warrant the purchase of a machine. To remove the iron is a nice job for the young apprentice. The turnings are spread out on a table and large horseshoe magnets are moved through them until little iron adheres. In a short time most of the iron is removed from the turnings.

Alloy Resembles Nickel

We want a formula for a cheap white brass that will polish to resemble nickel.

There are no cheap alloys of any kind that will polish like nickel. Cast iron is white and reasonably cheap, but it will never polish like nickel, this latter metal has its own individuality and it is difficult to imitate it exactly. An alloy that will greatly resemble nickel, is the following: Copper 65 per cent; nickel 32.5 per cent; aluminum 2.5 per cent.

Permanent Molds Favored for Production Work

By H. A. Schwartz

Fig. 1—Fluid Circulating and Demonstrating Equipment Installed for Demonstrating Purposes

EACH mold unit operating under the new process has incorporated the proper parting, gating and venting peculiar to the conditions of the casting for which it is designed. The parting, gating and venting are so arranged that the molten material enters the mold cavity with a minimum wash on the mold surfaces, and is so designed that the air and gases escape with a minimum resistance offered by the mold and forming casting. A greater part of the proper gating and venting is incorporated at the time that the mold unit is being built, but frequently it is necessary to make minor alterations in the gating and venting arrangement to meet special conditions not provided for originally. However, as more and more units for a greater and greater variety of casting types are put into operation, a fund of data on parting, gating and venting will have been acquired which will make unnecessary all but minor alterations in these respects.

Every unit, regardless of whether it is to be operated singly or in a group with other units, is independent of the others; being a complete casting unit within itself. Because of the fact that a single gang of men can operate a number of these units they usually are placed together in batteries; one gang of three men operating a battery.

The first man in the operating gang passes from mold to mold in his battery and prepares each for pouring. The second man follows the first and pours the molten material into the molds. The third man follows the pourer, opens the molds and ejects the formed castings. A battery usually is made up of a number of molds designed for producing castings of the same general size. If the production requirements warrant, all units in a battery may be designed to produce one type of casting. As a rule, when the castings are of large size, the battery has a fewer number of units to suit the handling ability of the operating gang. When the castings are smaller, the battery has a greater number of units because the operating crew is able to care for more units.

In practice it is aimed to obtain a certain minimum poundage of castings from each unit, regardless of the weight of the individual casting. If the casting is light, a number of these are gated together in one mold. Under present practice, the minimum casting poundage from each unit never should be less than 20 to 25 pounds, and with larger castings it has been found practical to obtain up to 50 pounds at each pouring. It must be understood that these figures do not indicate the producing limits of a new process by any means. They simply represent practice already established.

Production Methods

MANY recent developments in the art of pouring castings in permanent molds have followed the lines of automotive production. The new type of mold is used to make such castings for this industry as are needed in large quantities. In this article, which is the fourth and last of a series in which the author describes a permanent mold process of his own design, the results which were obtained on batteries of permanent molds engaged in making automotive parts in a modern production foundry are discussed. The first article of this series by Mr. Schwartz traced the development of long life molds and was published in the Jan. 15 *issue on page* 42. *In the second article the various factors affecting deterioration of the iron mold were discussed, this story appearing on page* 92 *of the Feb.* 1 *issue. The method of regulating the properties of the castings through a control of the mold temperatures was explained in the Feb.* 15 *issue starting on page* 147.

Each Unit Is Separate

If for some reason one unit in a battery is put out of service or it is desired to exchange a unit, even while the casting operation is in progress, fluid valves and a simple means of disconnecting or connecting the fluid service is provided for each unit so that the units may be exchanged or taken away without interruption to the casting operation.

A battery may consist simply of a stationary row of individual units or the battery may be arranged on a moving mechanism for bringing each unit in the battery before the operators, who remain stationary. This moving mechanism may take the form of a turntable, conveyor or reciprocating mechanism passing back and forth before the operators.

The individual units of a battery may be operated automatically, semiautomatically or manually. However, in every case each unit is independent in operation. The operating arrangement whether automatic, semiauto-

matic, or manual, depends entirely upon the production and casting requirements.

Each unit has a gas torch arrangement on the jacket side of the mold which is used to warm the cavity surfaces through the heating of the fluid within the mold chambers. Of course, the fluid circulating mechanism is not in operation while this warming up process is taking place. About 15 minutes prior to the beginning of casting operations are required for sufficient warming of the cavity surfaces to begin casting operations. After this had been accomplished, the heat absorbing fluid circulating mechanism is started and casting begins.

At intervals of about an hour or so, a thin film of carbonaceous material is sprayed on the mold cavity surfaces to help form the air and gaseous cushion between the mold and forming castings. As each casting is ejected from a mold unit, a jet of compressed air is used to clear the cavity of foreign substances. A casting is ready to be ejected from the mold within 15 to 30 seconds from the start of the pouring operation, depending upon the material and distribution of material in the casting.

The heat absorbing fluid circulating and pumping mechanism, together with the remaining auxiliary equipment used with the new process, is designed of a sufficient capacity to care for the needs of the particular installation for which it is intended. Main feed and return lines running to all the batteries in the installation provide branch outlets leading to each of the units. Flexible connections are used wherever the mold sections move with relation to each other. Two shut-off valves and two union connections running to the two branch leads from the main lines, are arranged on each unit. This makes it an easy and simple operation to shut off the fluid supply to a unit and disconnect same for exchange or removal.

Fig. 1 pictures a small demonstrating fluid circulating and regulating equipment used for demonstrating purposes in the plants of foundry concerns interested in learning at first hand of the possibilities of the process as applied to their own casting output. This equipment has a capacity of removing about 15,000 b.t.u.'s from the molds per minute. It should care for a battery of about six units of medium capacity. It is arranged on a unit basis so that its capacity may be increased by adding units of equipment to the installation. The equipment is arranged to regulate the volume, pressure and temperature of heat absorbing fluid entering into each of the units served by it. If the several units are to cast castings of a similar style and size, then a general temperature control may be maintained. If the temperature requirements of each of the units is different, then each mold is regulated individually either by thermostatic or manual valve control.

It has been demonstrated under actual conditions over a period of several years that the process will perform and accomplish the work expected of it. Nothing will serve better than an actual example to show the tremendous advantages that the Schwartz process may show over the old casting methods. One of the best equipped and modern production foundries in this country installed a number of batteries for operation under the process. These batteries were in operation for some time producing pistons and other castings, commercially. The first installation at this foundry included several batteries for casting pistons. Over 25,000 pistons have been cast from each of these mold units and they are considered to be in as good condition today as they were when first installed. Each of these batteries was made up of eight units arranged in a stationary row on the casting floor and operated by a gang of three men. Two of these batteries of eight units each, occupying about 600 square feet of floor space, can produce about 5000 pistons per day. Each unit was arranged to cast two pistons at one pouring.

This may be compared with the production obtained by this foundry by the sand mold method. The pistons were cast four in a flask. Two experienced molders on a floor space of about 600 square feet, made up 150

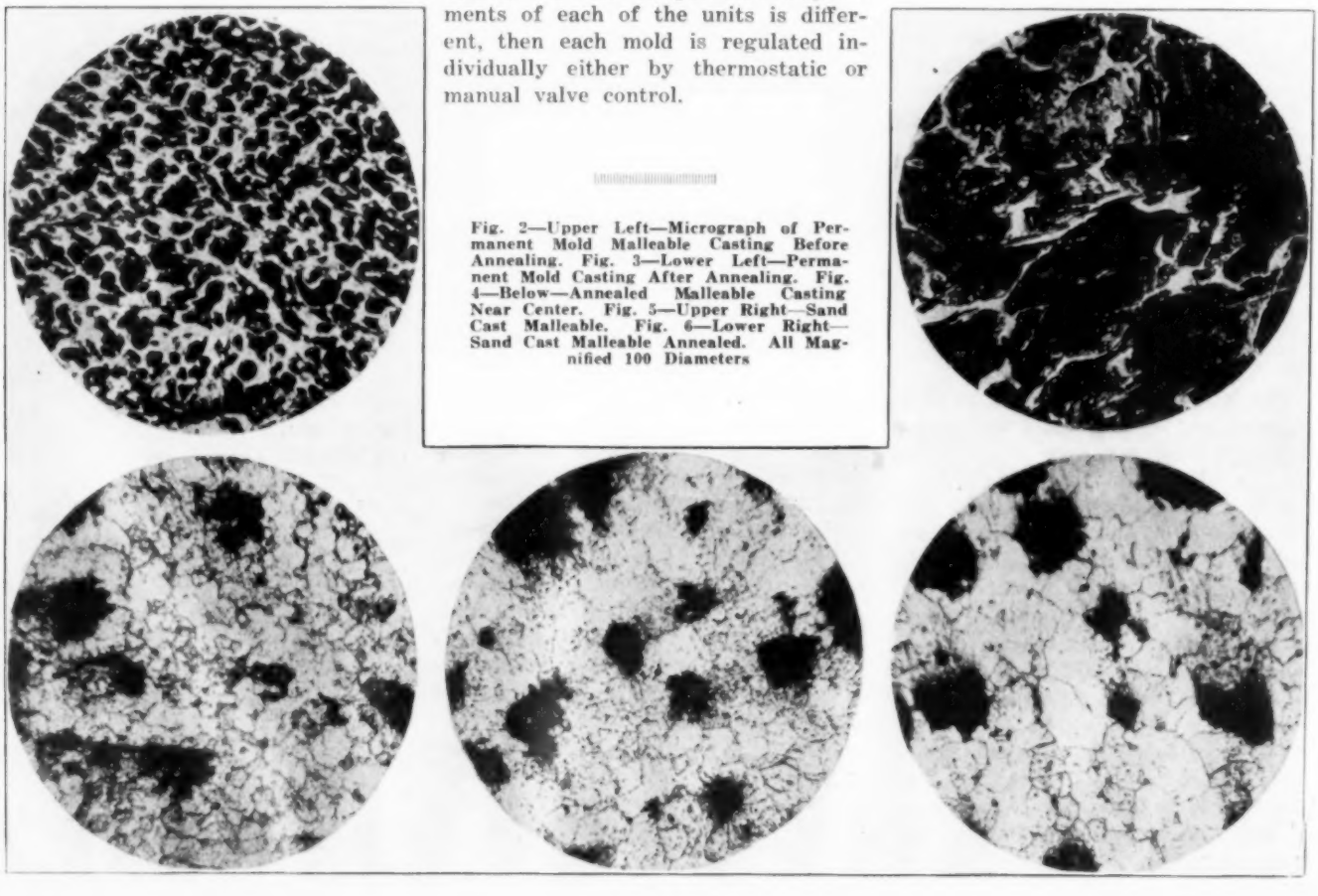


Fig. 2—Upper Left—Micrograph of Permanent Mold Malleable Casting Before Annealing. Fig. 3—Lower Left—Permanent Mold Casting After Annealing. Fig. 4—Below—Annealed Malleable Casting Near Center. Fig. 5—Upper Right—Sand Cast Malleable. Fig. 6—Lower Right—Sand Cast Malleable Annealed. All Magnified 100 Diameters

flasks in a day, producing about 600 pistons. The piston production from the long life mold installation per man per day was over 800 pistons, and 300 pistons were produced per man per day with the sand equipment. Each piston casting averaged about four pounds in weight. Using the permanent mold equipment 8.3 pistons were obtained per square foot of floor space per day, while with the sand mold equipment one piston per square foot of floor space was obtained. A production of 33.3 pounds of piston casting per square foot of space per day was obtained from the new process. Four pounds of piston casting per square foot of space per day was the production obtained from the sand mold method.

This foundry also has produced cylinder head castings for use on motor car engines by the sand mold method. The production obtained in sand molding has been 150 cylinder heads per day on 600 square feet of floor space, this work being accomplished by two molders.

Six operators can handle two six-unit permanent mold batteries on 600 square feet of floor space. Each battery of six units may produce six cylinder head castings for each four minute cycle, or the two batteries may produce 12 castings every 4 minutes. The cylinder head casting by the sand mold method weighs about 36 pounds and by the permanent mold about 32 pounds. Over 1400 cylinder head castings were produced from the new process per 600 square feet of space per day and 150 cylinder head castings were made from the sand mold method per 600 square feet of floor space per day. The production per man with the permanent mold process was 233.3 castings per day and by the sand mold method 75 castings per man per day. Over 22 tons of castings were produced per 600 square feet of floor space with the new process and by the sand mold method over 2½ tons of castings were produced on the same floor space per day.

Applied to Malleable

The new process is of exceptional value to the malleable industry because of inherent conditions present in this field to which the process particularly is adapted. First, a great share of the business of this industry is devoted to the mass production of standardized castings and second, the process, because of thorough temperature control, offers a reliable commercial method for casting malleable mixtures that would be easily controlled and that would respond quickly and readily to the malleable annealing operation. For instance, a malleable mixture with a higher silicon content could be cast in the permanent mold without danger of undue primary graphitization. The additional silicon contents should shorten the subsequent annealing operation materially; in the opinion of some authorities, to less than 10 or 15 hours.

A continuous system of melting would have to be used in conjunction with the process if the full value is to be realized. Malleable iron authorities have suggested several methods for securing a continuous molten iron supply. One suggestion is that a number of smaller sized standard malleable melting furnaces be arranged so that they are tapped progressively and thus obtain a continuous supply of molten metal. Another suggestion is that a combination of cupola, crucible and electric furnace be used.

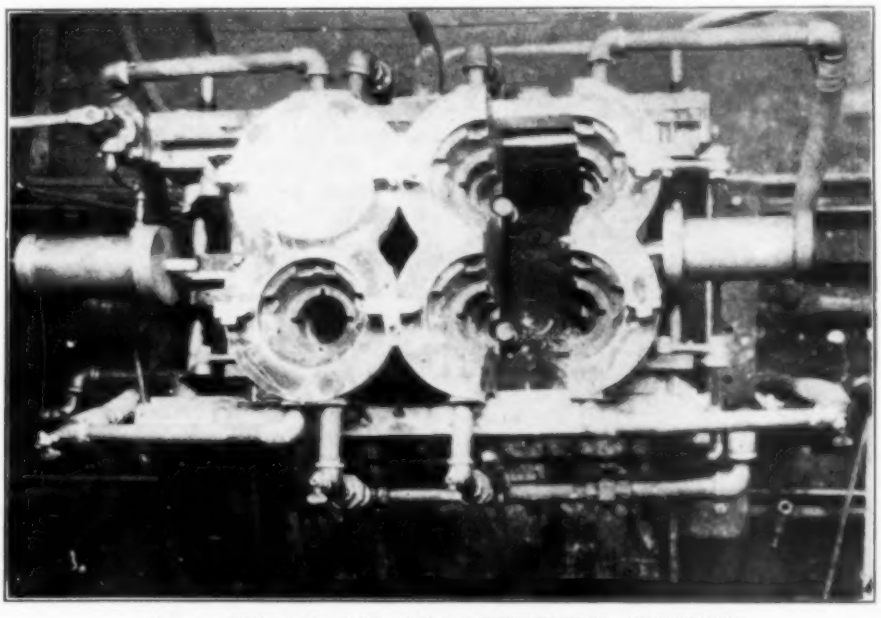


FIG. 7—UNIT TO CAST FOUR DIFFERENTIAL MOUNTINGS

One of the larger malleable concerns has installed a demonstration equipment similar to that shown in Fig. 7. This unit was built to cast four differential gear mountings at one pouring. To show the production possibilities of this unit it is estimated that a gang of three men, which includes the pouring attendant, could operate a battery of six of these units. The manner of operation already has been described in detail in this article. The battery may easily be operated once every four minutes. Therefore, a battery of six units would produce about 360 castings per hour.

The following comparative physical tests were made with two differential gear mounting castings cast from the same heat; one cast in a sand mold and one cast in the mold shown in Fig. 7. The two castings were annealed together. A load of 40 tons brought down on the sand casting, crushed the malleable iron structure at the two bends. A load of 50 tons brought to bear on the casting made in the permanent mold seemed to have no disintegrating effect on the malleable structure at the two bends produced by the load. A piece was cut out at this point in the permanent mold casting and, after etching, a micrograph was taken. It appeared to be perfectly sound.

Mr. J. J. White, metallurgist, the Erie Malleable Iron Co., Erie, Pa., prepared micrographs from test pieces taken from regular castings made from the same heat in a permanent and in a sand mold. Micrographs were taken showing the structure before annealing and after annealing. Fig. 2 shows a micrograph of the permanent mold casting structure before annealing. Fig. 5 shows a micrograph of the sand mold casting structure before annealing. Fig. 3 shows a micrograph of the permanent mold casting structure after annealing. Fig. 6 shows a micrograph of the sand mold casting structure after annealing. Although Mr. White has not completed his tests, he has expressed the opinion, based on what he has already seen, that the malleable structure of a permanent mold casting indicates a superiority to the sand cast malleable structures produced by his concern.

Casting Nonferrous Alloys

The new process has been applied to the casting of bronze and aluminum alloys experimentally. It promises to

produce to a marked degree the same improvements in physical properties and the same economy in production that has been found possible in the ferrous field. Although the trouble with high temperatures is not so great when casting aluminum alloys, the working control of the temperature conditions encountered makes the process valuable in this field. Of course, the temperatures met in casting hard brasses and bronzes are sufficiently great to make the process valuable for this purpose. Demonstration installations are about to be placed in several nonferrous foundries and development in this direction promises to be interesting in the relatively near future.

Pattern Changed To Facilitate Molding

BY C. J. MORRETTE

IGNORANCE of foundry practice on the part of the patternmaker was responsible for considerable expense and loss of time in the production of a suitable pattern for the job shown in the accompanying illustration. The drawing as it was sent to the patternmaker is shown in Fig. 1; the first master pattern as it left the pattern shop is shown in Fig. 2 and the method finally adopted to meet the requirements of the foundryman is shown in Fig. 3. The dotted line in Fig. 2 indicates the amount of extra metal considered necessary for machine finish.

The pattern was made in three sections, parted at the lines *AA* and *BB*. The center section, hub, arms and rim, were made in one piece and the upper and lower internal flanges were designed to fit on the body with dowel pins. The patternmaker evidently was under the impression that the mold could be made in a 3-part flask. If the job had been designed simply as a test in molding skill, it would have served the purpose because the mold *could* have been made in the manner indicated. The only objection is that the method is not practical on a production basis. Further it was not necessary to provide such a liberal margin for machine finish.

A practical pattern, one that meets the foundrymen's requirements finally was made as shown in Fig. 3. It will be noted that the work was divided in such a manner that the pattern formed the outside of the mold and the inside was formed with a dry sand core. The pattern was made up solid with a tapered core print top and bottom. The core was symmetrical from center line, Fig. 3 and therefore a single corebox sufficed to make all the half cores which afterward were pasted at the joint line after the small center core was inserted. This form of pattern construction simplified the molding process and produced satisfactory castings in an economical manner.

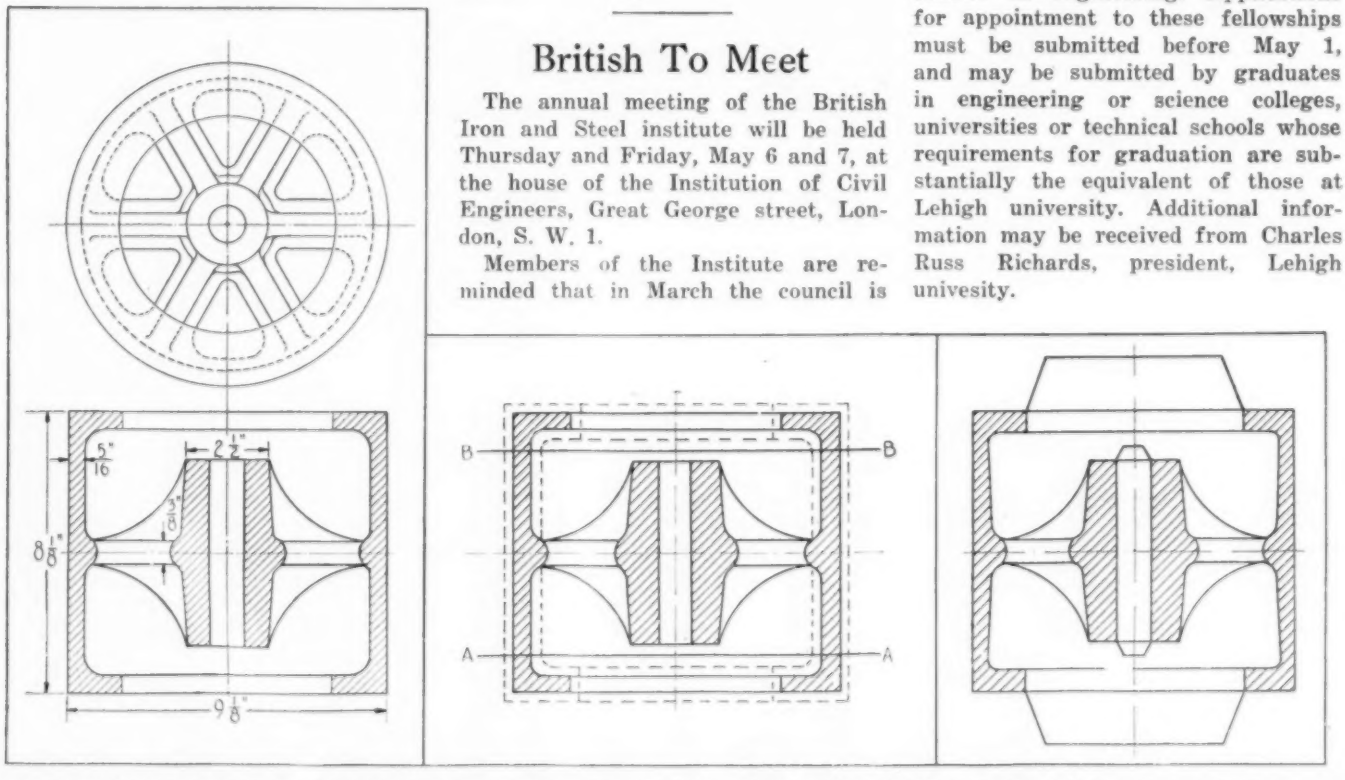


FIG. 1—THE DRAWING AS IT APPEARED IN THE PATTERN SHOP. FIG. 2—PATTERN DESIGNED TO BE MOLDED IN A THREE PART FLASK. FIG. 3—PATTERN MADE ACCORDING TO FOUNDRY REQUIREMENTS

British To Meet

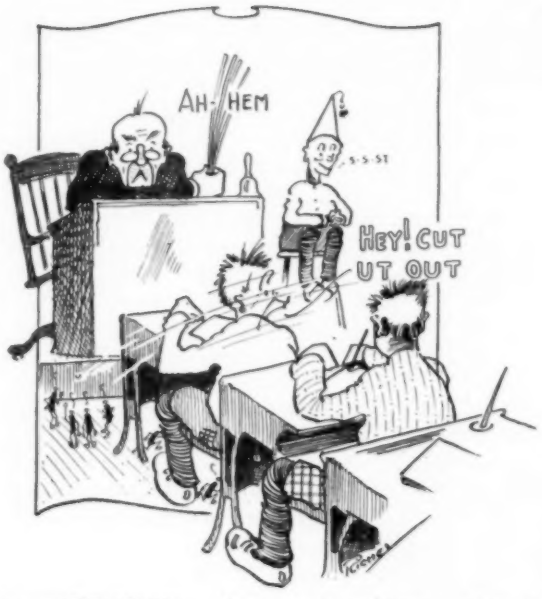
The annual meeting of the British Iron and Steel institute will be held Thursday and Friday, May 6 and 7, at the house of the Institution of Civil Engineers, Great George street, London, S. W. 1.

Members of the Institute are reminded that in March the council is prepared to consider applications for grants from the Carnegie fund for research work on some subject of practical importance relating to the metallurgy of iron and steel or allied subjects. Special application forms may be obtained from the office of the Institute at 28 Victoria street, London, S. W. 1. The results of research work must be communicated to the Institute in the form of a report.

It is expected that, by the kindness of the Swedish ironmasters, the autumn meeting of the Iron and Steel Institute will take place at Stockholm.

Offer Fellowships

The institute of research, Lehigh university, Bethlehem, Pa., will appoint three research fellows on or before June 1 as follows: One New Jersey Zinc Co. research fellow in science and technology and two Henry Marison Byllesby memorial research fellows in engineering. Applications for appointment to these fellowships must be submitted before May 1, and may be submitted by graduates in engineering or science colleges, universities or technical schools whose requirements for graduation are substantially the equivalent of those at Lehigh university. Additional information may be received from Charles Russ Richards, president, Lehigh univesity.



Bill Explains Cause *of* Shifted Castings

By Pat Dwyer

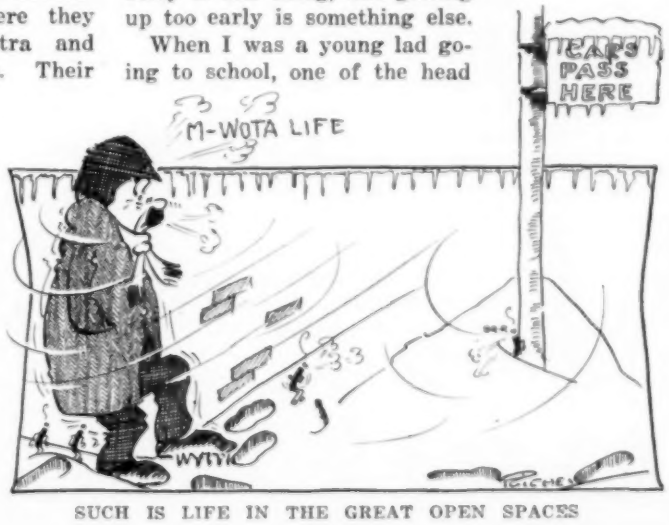
THROUGH a long and arduous course of intensive training and application many men have succeeded in developing their power of memory to a high state of perfection. Witness our old friend Mr. Addison Simms of Seattle. I forget for the moment whether Mr. Simms was the gentleman who either sold or bought the car of lumber to or from a customer back in 1904, or simply was the customer who recognized the lumber dealer when he met him again at a Rotary convention in San Francisco in 1920. The point really is immaterial. One of these two gentlemen had a marvellous memory. A bare possibility exists that the bill for the car of lumber was unpaid and that would account for the keen memory displayed by at least one party to the transaction. So far as I can remember this feature never has been touched upon, therefore, I hesitate at drawing any sweeping conclusions.

Many men gifted at birth with a musical ear and a set of nimble fingers cultivate the gift and eventually arrive at a point where they are accepted in an orchestra and thereafter lead an easy life. Their work is all play. Little boys endowed with the peculiar traits usually ascribed to a barber's cat and who practice these virtues unceasingly for many years develop into politicians and are supported in ease for the remainder of their lives by a grateful public. Through natural limitations of one kind and another I cannot qualify in any of the foregoing lines, but in my humble way and entirely without concious effort I have arrived at an equally distinguished goal. I can fall asleep any time and in almost any place in a few minutes. Do not jump to conclusions too hastily. You only have read one half of the story. For many years after I started on the long, long road, nothing short of a fire, a flood or an earthquake could wake me after I once was soundly asleep. Now, almost any trifling noise, a door banging, a telephone bell ringing or a fire engine dashing past will wake me out of the soundest sleep. Thousands of incidents spread over a long period in connection with raising a large and assorted family may be partly responsible for this condition, but what ever the reason, it has placed me in a position I am sure I never would have achieved voluntarily and as our legal friends say, with malice aforethought.

From an occasional perusal of the sporting pages of the newspaper I have gathered the impression that one may over train in any line of endeavor. While I am not prepared to claim that this peculiar accomplishment of mine should be classed under the head of athletics, still a recent incident has led me to wonder if I am not becoming too expert in the sport of early rising. Getting up early is one thing, but getting up too early is something else.

When I was a young lad going to school, one of the head lines in the copy book related how a person—name, age or telephone number not given—had lost one hour, studded with 60 golden minutes, each minute set with 60 diamond seconds. The line further stated gloomily that no reward was offered, they—meaning of course the entire collection, hours, minutes and seconds— were gone forever.

The dreadful significance of the warning may have impressed some of the scholars. Perfectly useless young creatures who took their work seriously, earnestly tried to do everything they were told and implicitly believed every word uttered by the little old crab who sat on the platform. The line appealed to me as nothing but the purest drivel to be copied as rapidly as possible and a sufficient number of times to fill the page. Whether it could be read afterward was a matter of supreme indifference to me. As I saw it, my only task was to fill the page. Comments I have heard on my writing in after years have led me at times to wonder if perhaps I was not in a little to much of a hurry. Fortunately, later I became acquainted with a typewriter, an instrument which sets down the characters automatically and with painstaking accuracy and therefore I have no regrets for the pen I abused in my youth. However, to return to the precious hour. The incident to which I referred a few minutes ago seems to indicate that the old dead and forgotten school master who wrote the copy book head line had a fairly accurate knowledge of the value of time. I lost a precious hour the other day and while an hour more or less among friends is not an item of major importance, still this particular hour was lost under such peculiar circumstances that I expect to hear many allusions to it in the future. Instead of the



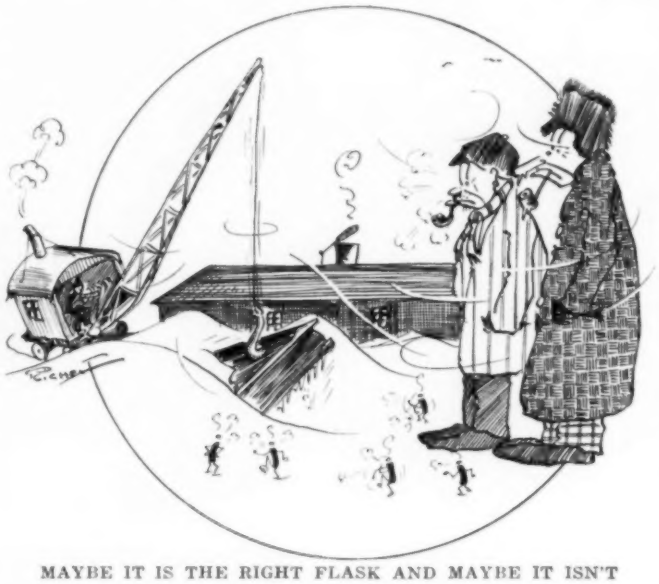
SUCH IS LIFE IN THE GREAT OPEN SPACES

sympathy to which a loser is entitled, especially from members of his own family, all I have received up to the present is ridicule.

Following my usual custom, a custom to which I previously have referred as having been developed through a long period of intensive training, I automatically opened my eyes a few minutes before 6 a. m. one bitterly cold morning last week. I lazily congratulated myself on having a few minutes to spare and decided to wait before arising until I heard the clock downstairs strike the hour. I was somewhat surprised to hear only five strokes, but decided that either the clock was run down or that I had made a mistake in the count. Hastily jumping out of bed I rushed downstairs to shake up the fires and then called the lady of the house who is graciously pleased to prepare the modest breakfast while I shave, finish dressing and in general trim myself for presentation before my fellow citizens in the great hive of industry. Before sitting down at the table I decided to wind the clock. I found the minute hand over the key hole which marks 20 minutes of the hour and that diverted my mind from the hour hand which I unconsciously assumed was over the VII. Also I had neglected to switch on the light in the living room since the light from the adjoniing room furnished all the illumination I considered necessary. The incident has taught me a lesson. Hereafter I am going to switch on all the lights in the house when I arise and in addition I will carry an electric torch when I go to wind the clock. At various times, later in the day I mentally toyed with the alluring prospect of smashing the clock with a large sized hammer and throwing the remains in the furnace, but reluctantly I was forced to abandon the idea. A little sober reflection convinced me that the executive head of the house would welcome the opportunity of buying a much larger and more elaborate time piece which probably would have to be wound every day. I am willing to assume my fair share of the household burden, but to maintain any self respect a man has to draw the line some place. Winding a big brute of a clock every day is piling it on a bit too thick.

If I had been at all suspicious or even mildly observant I would have wondered at the absence of the numerous whistles which punctuate the air between 6:30 and 7 a. m. After breakfast I donned the hat and overcoat and in passing through the room I idly noted that the minute hand of the clock marked 10 minutes past the hour. This seemed perfectly natural and I headed cheerfully down to the corner where I board a car.

While on the way to the corner the first faint suspicion that all was not well entered my mind. The street was deserted. Not a light showed in a window. A frozen moon hanging in a frosty sky about 15 degrees above the horizon carried my mind back 30 years in a single jump to other nights when the same old moon in the same position had lighted my weary way home from many a dance in the wee small hours.



MAYBE IT IS THE RIGHT FLASK AND MAYBE IT ISN'T

The suspicion became almost a certainty when I arrived at the corner and found not a single member of the crowd which usually boards the car with me at this point. While I was debating the advisability of returning to the old homestead to check up on the time the car arrived and I hopped in through the door. One look at the passengers convinced me that my worst fears were realized. The car was filled with hardy sons of toil. Heroes who start the lusty hammers ringing on the anvils of industry between 6 and 7 in the morning. A most unholy hour at any time of the year, but particularly abominable in the winter.

Manifestly I could not turn back at this stage of the game. I selected one of the few unoccupied straps, resigned myself to my fate and as you might say in a word let nature take its course. As the men dropped off here and there I derived a certain measure of consolation from the reflection that my ultimate destination was not a cold, draughty foundry in which the sand was almost frozen and where the rammer was about as comfortable a tool to grasp as a long, shiny icicle from one of Greenland's well known mountains.

If there is any more dreary and desolate place in which to work than a big jobbing shop on a winter morning I have not seen it. The air is filled with acrid, irritating wood smoke from the salamanders. Empty flasks and lifting plates are piled drunkenly askew all over the floor. Crane ladles that were filled with blazing lakes of white hot metal on the preceding evening now stand cavernous and cold, huddled in a pitiful group on the floor in front of the cupolas. Empty and desolate shells from which the spirt of life has departed apparently never to return. Through some inscrutable law of divine providence all new jobs are started on the coldest days of the year. The big doors in the end of the shop must remain open for an hour or two while one set of flasks is taken out and a new set of rigging brought in from the yard. Invariably the required flask is on the bottom of the pile and is frozen fast to the ground. Usually also the entire pile is buried under a mantle of snow and the flask man is not sure if the required flask is in this pile or in that one over there.

The heaviest heats always are scheduled for the coldest days and by a curious coincidence half the yard gang unavoidably are detained at home on these days looking after sick wives and attending funerals. Just when helpers are most urgently needed on the floor the gaffer has to send them out to hustle up stock to the charging platform. At this kind of work they are about half as efficient as the regular crew and as a result the old man is as cheerful a companion as a hungry bear with his nose stuck full of porcupine quills.

Meditating bravely and quite cheerfully on these and kindred topics I arrived at the scene of my daily toil at 10 minutes of 7. I might have said 6:50, but that figure 6 gives me the shivers. The elevator man eyed me suspiciously and inquired what in the name of John

Brown's immortal body and bones I was doing there at that hour.

I might have countered by asking him to explain his own presence, but I had a sudden inspiration that perhaps he roosted all night in the cage like a canary bird. I know he is on duty when I leave at night and he always is there when I arrive in the morning.

Conceivably I might have returned an evasive answer or I might have put on the high hat and remarked frostily "9 please." I did neither. I am a firm believer in the good old policy of answering civil questions in a truthful and courteous manner. I looked him fearlessly in the eye and told him I had been out all night.

Some person must have passed the good word along to Bill. When he came in last night he ostentatiously pulled out a gold watch that was presented him one time for something or other, probably as a token of relief at his departure, and compared it with the clock on the mantle. He dropped the watch back in his pocket with a sigh of relief and remarked that so far as he could see the clock was alright.

"What you need" said Bill "Is a good reliable watch, or a pair of glasses or perhaps a guardian. Something or some person to prevent you from climbing out of bed and going prowling around town in the middle of the night like a homeless cat or a banshee out of a regular job."

Quite properly I might have pointed out to Bill that the illustration not only was grossly inaccurate, but was decidedly in poor taste. So far as my knowledge extends cat's and banshee's only claim to fame is based on their ability to make the welkin ring. Frankly, I don't know what a welkin is, but I am reasonably sure if I asked Bill he would answer me simply and courageously: "So's your old man!" I might have directed his attention to the fact that my adventure in the cold and chilly dawn was anything but boisterous. No indeed. I was about as noisy that morning and for the remainder of the day, as a graven image. With a view of turning Bill's mind into more pleasant and congenial channels I told him of my meditations on the foundry.

"Well" said Bill "I'll tell you. The foundry is a funny place. If it is not one thing it is another to keep a fellow guessing from morning until night. One of my side floor lads came to me the other day to see if I could explain why the row of castings nearest the sides of the mold showed a shift while those in the center presented a perfect match. Individual patterns for small wheels were machined and inserted in an aluminum plate for use on a squeezing machine. The greater part of each pattern was on the drag side of the plate. The lad was inclined to blame the machine. One of these birds who is to be found in every foundry, who has a reason for everything and generally knows nothing, had told him machine made molds shift more than molds rammed by hand.

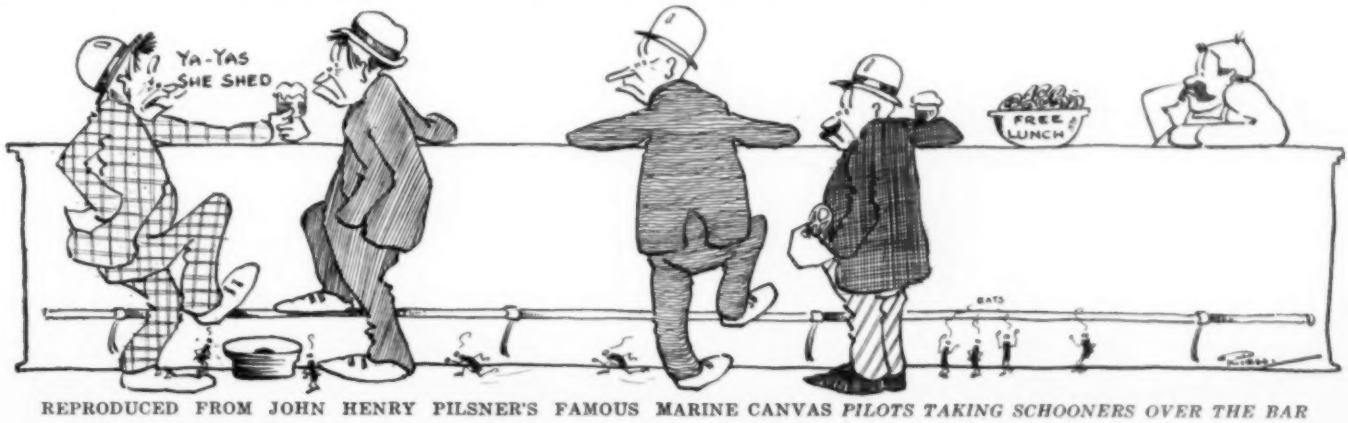
"I told this seeker after knowledge that his adviser was full of cheese, Swiss cheese, the kind that is filled with holes and therefore about two thirds vacuum and the remainder is only fit to bait a mouse trap. I directed his attention to the plate in which each of the patterns was an entire unit. Therefore one of the usual causes of shifted castings automatically was eliminated.

"Sometimes when two independent halves of a pattern are fastened on opposite sides of a plate, they do not truly match and naturally the result is a miss-matched casting. With the pattern equipment exonerated, the next most prolific cause of shifted castings is loose guide pins, or guide pins set slightly from the perpendicular. Loose guide pins easily are detected and the remedy is obvious. Crooked guide pins are a more insidious form of menace. To the casual eye they are smooth, straight and close fitting, but in actual practice they guide the cope into a position slightly away from where it is expected to land.

"When the cope is in ramming position it is separated from the drag by the thickness of the plate and the guides on the plate are at a certain point on the pins. If the pins are truly perpendicular the cope will settle straight down on the drag when the plate is removed. If the pins are set on a slant the cope will be deflected more or less to one side depending on the thickness of the plate and the distance the pins vary from a true perpendicular.

"Shifted castings are no more prevalent among machine made molds than among molds rammed by hand. By the foregoing process of elimination I showed the young man that his castings were strained and not shifted. Instead of placing a steel band or a tight fitting slip jacket around the mold he had been depending on rickety old wood jackets that had out lived their usefulness and only were fit for kindling wood in the cupola. That part of the mold in the outside of the drag was pushed outward by the pressure of the metal and the casting showed a shift at the joint line. The difference between a strained casting and one that merely is shifted may be detected with a pair of calipers. The strained casting will be swelled out of shape on the side next to the outside of the mold. In the casting that merely is shifted the drag will not match the cope, but the dimensions remain unchanged.

"That silly remark of the molder" said Bill "About the machine being responsible for the shift is on a par with the conversation of the two drunks. One said to the other 'Shay, Tom o' man do you know fellah name Jim Mason?' The second pickle steadied himself and replied with owlish gravity 'No, can't say as I do. Wha's bird's name?' The first speaker eyed the second with pained surprise and said: 'Who you talking 'bout?'"



REPRODUCED FROM JOHN HENRY PILSNER'S FAMOUS MARINE CANVAS *PILOTS TAKING SCHOONERS OVER THE BAR*

Burning Fuel Oil Efficiently

Type of Furnace and Continuity of Operation Important Considerations in Operating Oil-Fired Industrial Furnaces

By Max Sklovsky

INTEREST in research for more economical use of fuel oil was stimulated in 1912 by the radical increase in price which took place during that year. In searching for a substitute fuel, it soon was discovered that it would be a serious detriment to production and production costs to substitute solid fuels, such as coal or coke, and it was found also that the price of gaseous fuel which could serve as a substitute was prohibitive in the majority of cases by reason of the cost of the installation of gas-making apparatus. A check-up in one case, as illustrated in Fig. 2, indicates the production range on an ordinary forge furnace, on an ordinary fuel oil furnace, and on an improved type oil furnace. The corresponding production units range from 450 to 1250 and up to 3100. The corresponding cost is indicated in the figure adjacent to each diagram, showing corresponding cost of $1.50 to $2.75 and $3.50 per 100 pieces. Fig. 3 gives relative labor and fuel cost on the same furnaces, showing on the coke furnace a labor cost of $16.50 plus a fuel cost of $3.50; on a regulation type of fuel oil furnace a labor cost of $8.50 and fuel cost of $2.50; and on an improved type of oil furnace a labor cost of $2.80 and a fuel cost of $1.20. This investigation has proven that the advantages of liquid fuels are so great, both as to production as well as labor costs, that the cost of fuel is relatively a minor item, that in place of substituting another fuel it would prove advantageous to continue the use of fuel oil, and that active effort should be made in the direction of more economical use of such fuel to reduce fuel cost as well as to conserve supply.

Investigation of the various types of furnaces and their combustion in general use at the time indicated a very wide fluctuation in the economy of such furnaces. A total of 251 individual furnaces were checked up and classed into six groups with economy results as follows:

	Per cent
Box type	11.6
Rotative type	9.65
Continuous thoroughfare type	13.8
Continuous type, another group	17.5
Welding furnaces	8.9
Open type	1.2
Average for 251 furnaces	9.2

This group applies to types of furnaces specially developed for production purposes and adapted for a limited number of jobs. The average economy as a whole, all over the country, is scarcely 5 per cent. By the per cent of economy is meant, in this case, the ratio between the heat contained in the metal and the heat contained in the fuel supplied to the furnaces.

The striking inefficiency of metallurgical furnaces brings up the question as to what becomes of the heat. Experiments with a small forge furnace indicated that 9 per cent of the heat was utilized, 47 per cent went up with the spent gases, and the balance, 44 per cent, was radiated. This same furnace was rebuilt with a 9-inch wall and arranged with proper and suitable openings. This simple change resulted in 18 per cent saving in fuel, all of which was obtained by reducing the radiated heat from 44 down to 26 per cent.

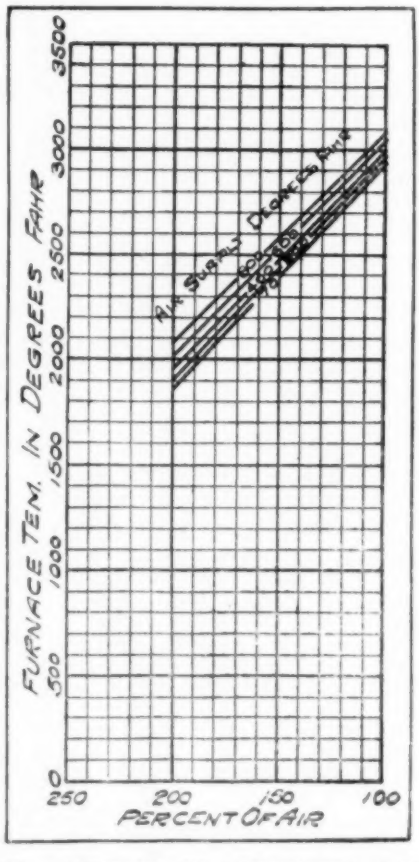


FIG. 1—EFFECT OF PREHEATING THE FUEL ON THE FINAL TEMPERATURES

It appears at first glance that, for the purpose of production and fuel economy, the high temperature of a furnace is the most important factor, and further that as such high temperature is a result of the elimination of dilution by excess air, all that would be necessary is to control this excess air by some simple device. It is a fact, however, that attaining such control is not so simple as it appears. The combustion of liquid fuel and particularly fuel oil is accompanied usually by a large amount of excess air, such excess air being usually about 100 per cent in the average furnace. Even under favorable conditions such excess air is rarely under 50 per cent. An enormous dilution, therefore, exists, with consequent reduction in temperature, which in turn reduces the economy as well as the productive capacity.

The immediate reason for oversupply of air in combustion of fuel oil is the elimination of smoke. A smoky furnace is not suitable ordinarily for production purposes and it has been found that the injection of excess air readily eliminates the smoke from the furnace. The real difficulty lies in the relatively slow combustion process. To demonstrate, fuel and air may be injected in a furnace at a lineal velocity of 100 feet per second. With a furnace of ordinary size, five feet in length, this mixture reaches the other end in 1/20 of a second. During that period complete combustion must take place, that is, before the fuel mixture traverses the complete distance of the furnace. The air is injected in the form of a gas, whereas the fuel is used in the form of a fine liquid spray. Even so the sprayed particles of the liquid are billions of times larger than the molecular oxygen units in the air. In order to obtain complete combustion there must be a complete intermixture of the fuel and the oxygen. To accomplish this the fuel must therefore be converted into a gaseous form, otherwise the combustion takes place on the surface of the sprayed particles of fuel; and before that is completed the mixture is

From a paper presented before the meeting of the American Iron and Steel institute, New York, Oct. 28, 1925. The author is chief engineer, Deere & Co., New York.

frequently exhausted from the furnace into the atmosphere at which point chilling takes place, combustion ceases and smoke ensues. It has been found that thorough agitation accompanied with excess air increases the rate of combustion and thereby eliminates the smoky effect mentioned.

Making Combustion Complete

Mixing of a fuel with air when both are in a gaseous condition gives smokeless combustion under nearly all conditions, hence the conversion of the fuel into a gaseous form prior to admission into the furnace proper should permit complete combustion at a rapid rate with less excess air.

Experiments were conducted on a small forge furnace having a hearth volume of about 3 cubic feet. The furnace was equipped with an ordinary spray type burner and measurements indicated the consumption of 11.3 gallons per hour. By equipping this same furnace with a gasification fixture, it was possible to obtain complete combustion without smoke and permit the same quantity of stock to be heated with a fuel consumption of 6.5 gallons per hour. The gasification of the fuel permitted the use of less excess air, increasing the furnace temperature materially, hence requiring less fuel to heat the burden.

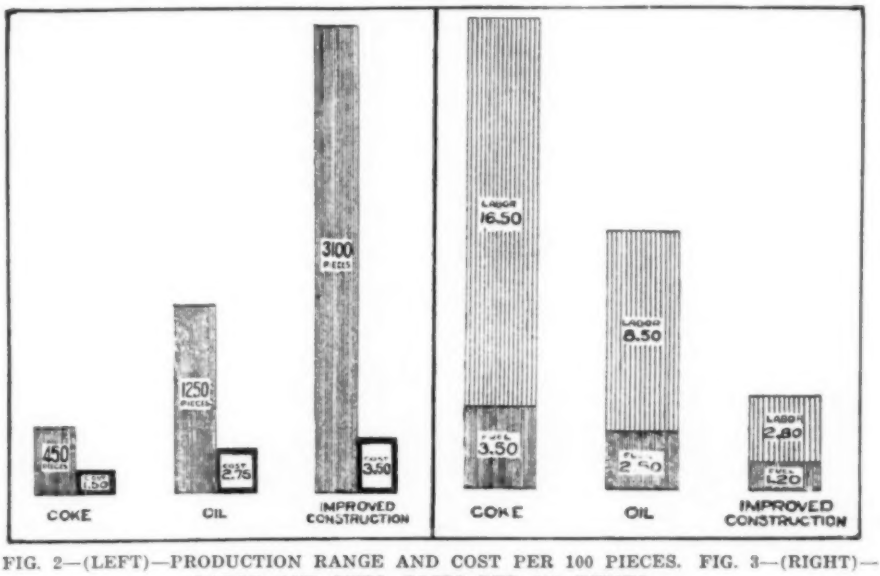


FIG. 2—(LEFT)—PRODUCTION RANGE AND COST PER 100 PIECES. FIG. 3—(RIGHT)—LABOR AND FUEL COSTS PER 100 PIECES

It had been noted previously that the fuel mixture in a furnace passes through so rapidly that it remains in the furnace only a fractional part of a second and thereby the products of combustion do not give up the heat to the furnace to the extent that would be possible were such products allowed to linger longer in the furnace. By the construction of a stock preheating chamber in the exhaust passages of the furnace, such furnace is effectively increased in capacity without increasing the primary heating chamber. By the process of preheating the stock a further reduction of one gallon per hour on the same furnace was obtained, and the oil consumption was reduced to 5.5 gallons per hour. The proportioning of the furnace to the product also had an effective result upon fuel economy. For further tests, therefore, a new furnace was substituted, in which the gasification of the fuel and the preheating of the stock were provided for and the furnace was advantageously proportioned in reference to hearth size, fuel openings, and wall thickness, with the result that the fuel consumption was finally reduced in daily use to 4.1 gallons per hour, a reduction of 7.2 gallons from the initial practice of 11.3 gallons, or a total of 64 per cent. In this instance the furnace efficiency was increased in regular production from 6 to 17 per cent.

In the gasification process used the air supply for combustion was preheated to 700 degrees Fahr. by utilizing the exhaust heat from the furnace. This air was preheated to furnish a means for gasifying the oil prior to admission into the furnace. It may be assumed erroneously that the preheating effect of the air accounts for the marked increase in economy. While the preheating does have a value, the greatest value comes from the gasification of the fuel, which permits a closer control of excess air. To demonstrate this, Fig. 1 shows a chart of the effect of preheating on final temperatures. The top diagonal line showing air preheated to 800 degrees Fahr. finally results in an increase in temperature of combustion of only about 175 degrees. This is an appreciable increase, but not in keeping with the increase that had been expected.

It had been indicated previously that higher temperatures radically affected the rate of heat transmission in a furnace. On the other hand it is generally assumed, and quite naturally, that to maintain higher temperatures takes a greater amount of fuel. To demonstrate this, a series of experiments were made, showing the oil consumption and furnace temperature. The furnace was of the ordinary type with an ordinary spray method of injecting the fuel. As the temperature rose from 1800 to about 2400 degrees Fahr., the fuel consumption gradually increased from about 4.8 gallons per hour to 6.9 gallons per hour—a material increase but not in proportion to the effectiveness of heating at the higher temperature. From 2400 to 2600 degrees Fahr. the increase in fuel consumption was from 6.9 gallons to 7.3 gallons, a lesser increase than the previous one. From 2600 to 2800 degrees Fahr. there is only an increase of 1/10th of a gallon per hour.

In a series of tests made on the same furnace, except that there was a pre-mixing and gasifying device for the fuel, the results were rather surprising in that from 1800 to 2400 degrees Fahr., the fuel consumption remained substantially constant and from 2400 to 2800 degrees Fahr., the fuel, instead of increasing to maintain the higher temperature, actually decreased. What occurred to produce a lower fuel consumption was that, after the temperature of the furnace advanced to a higher degree, the gasification under those conditions became more effective and permitted a constantly decreasing air supply or a continuous reduction of excess air within the furnace. This reduction of excess air permitted an increase in temperature and at the same time a reduction in fuel consumption. The answer to the question as to the fuel consumption for higher furnace temperature is that higher temperature does not necessarily mean greater fuel consumption and that, where higher temperatures are advantageous, fuel economy is also obtainable.

Preheating Fuel Oil Satisfactory

Preheating of liquid fuel by heating and gasification before admission to the furnace works satisfactorily on ordinary fuel oil without difficulty. The temperature required to gasify such oil is about 700 degrees Fahr. The air is therefore heated to that temperature before the oil is introduced to mix with it. There are some oils, however, which at temperatures of 700 degrees Fahr. tend to

crack and deposit carbon in the gasifying apparatus, thereby interfering with proper operation of the furnace. Experiments were conducted with the object of eliminating vaporizing fixtures, by direct introduction of fuel oil in the furnace, causing the vaporization of the oil and mixing same immediately upon entrance into the hearth of the furnace. This consisted in introducing a diaphragm near the nozzle, as illustrated in Fig. 4. It will be noted that this diaphragm, which is made of refractory material, has an opening opposite the nozzle which permits the mixture to pass through without interruption or deflection into the hearth of the furnace. It is to be noted also that the opening in the diaphragm is larger than the opening of the nozzle, with the result that, due to the velocity of the air and fuel mixture, a suction is established in the diaphragm opening, which draws in some of the hot gases from the hearth around the diaphragm, so that within the diaphragm opening there is a violent mixing of extremely hot gases with the incoming mixture, thereby instantly vaporizing the sprayed oil and causing the most rapid combustion. Fig. 5 shows a modified form for practical construction in which, in place of a diaphragm set out into the hearth, the wall construction at the nozzle is such as to permit a recirculation of enough of the hot gases from the furnace around the diaphragm which is set into the wall, permitting the adoption thereby of a substantial construction.

Smaller Furnace Is Possible

It may be pointed out in this connection that ordinarily the highest temperature within the furnace is located on the side opposite to where the fuel mixture enters. By this recirculation method through the diaphragm the combustion occurs earlier, that is, in the space near the entrance of the fuel blast in the hearth. As a consequence the entire hearth is more uniformly heated and it can therefore be utilized to the fullest extent, with the result that a smaller chamber can be used and therefore with less fuel consumption. The oil in this case is admitted into the nozzle near the wall so that but little preheating of the oil takes place and permits the use thereby of any grade of oil, light or heavy, without any carbon formation. It also permits the use of the highest temperature in the air. Temperatures of 1000 degrees Fahr. or more can be used without any risk of pre-ignition.

Maximum value of the fuel is obtained when the combustion takes place within the hearth and not in chambers extraneous to the hearth. Such devices as combustion chambers serve the purpose frequently of enlarging the furnace and causing excess fuel to be used. Fig. 4 indicates diagrammatically a furnace chamber with a diaphragm as described, an air preheating or recuperating fixture and the air connections to the nozzle and oil supply line to the nozzle at the entrance to the furnace. The amount of recuperation depends upon the exhaust temperature of the gases from the hearth and upon the fixtures used for heating the air for combustion. The diaphragm has the effect of inducing circulation of the gases in such a manner as to heat the furnace hearth uniformly and all over. Deflectors have been used at times for recirculation purposes but as reflectors or baffles cause concentrated combustion at such baffles, the baffles deteriorate rapidly.

Better fuel economy is obtainable, as indicated above, by higher furnace temperatures and by controlling the ratio of air to fuel. Other items of economy, as indicated, consist in air recuperation and in preheating of the stock in a preliminary operation by utilizing the exhaust or spent gases emanating from the combustion chamber. The first two items deal with efficiency in combustion and the latter two deal with efficiency of utilization of the heat of combustion.

Other means also exist which permit better economy in the using of liquid fuel. These are influenced by the furnace construction. Among these is the furnace size. As indicated previously, furnace efficiency averages about 5 per cent; the balance of the heat is wasted, the waste being ordinarily 95 per cent. This waste is a factor of the furnace; and the quantity of waste, that is, the amount of fuel used to sustain the temperature in a furnace which is termed usually the "furnace factor," is mainly dependent upon the size of the furnace. For example, a furnace using 15 gallons of oil per hour under full production, may under idle conditions use 60 per cent, or 9 gallons per hour, to maintain the working temperature.

A factor affecting fuel economy is that of continuity of operation. The initial building up of temperatures takes an appreciable period of time and consumes fuel. When such period is followed by a short operating period, the fuel consumed for the first period is frequently as much or greater than that consumed during the utilization period.

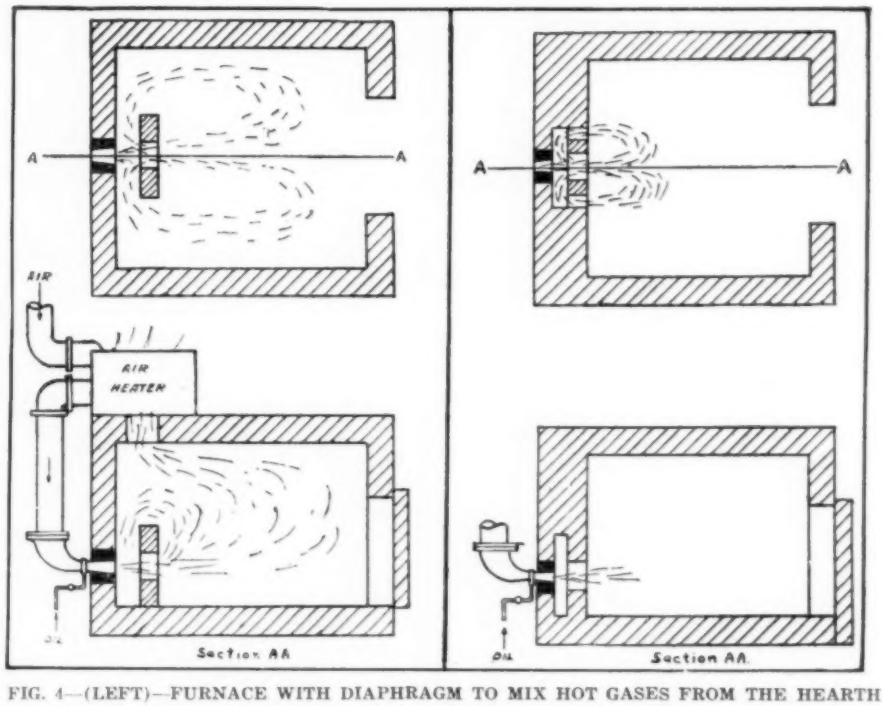


FIG. 4—(LEFT)—FURNACE WITH DIAPHRAGM TO MIX HOT GASES FROM THE HEARTH WITH THE INCOMING GASES. FIG. 5—(RIGHT)—MODIFIED FORM OF CONSTRUCTION WITH DIAPHRAGM SET INTO THE FURNACE WALL

Three Roads to Economy

As may be gathered from the foregoing, three distinct directions of effort may be applied for obtaining better fuel economy:

1. Proper combustion efforts.
2. Better furnace adaptation and construction.
3. Better attention to the furnace.

The goal of obtaining an average of 15 per cent efficiency on the whole is worth while and within practical attainment.

Screws Fasten Pattern Parts

Nails and Brads Also Used Extensively by Patternmakers — Various Sizes Should Be Carried in Stock

By Walter C. Ewalt

SEVERAL kinds of nails or brads, usually of the bung head or finishing type, are used in making patterns. The sizes of the nails used depend on the size and the type of work being done. Brads are ordered by number, for example the 1-inch size coming in numbers from 7 to 20 inclusive, No. 20 being the smallest in diameter. Brads are made in lengths ranging from 3/16 to 4 inches inclusive.

Since the large number of styles and sizes makes it undesirable to have all numbers in stock, the following numbers will be sufficient for the general run of work:

Length inches	No.	Length inches	No.
3/16	24	1¾	16
¼	22	2	16
⅜	20	2¼	12
½	20	2½	12
⅝	20	2¾	10
¾	20	3	10
1⅛	17	3¼	10
1¼	17	3½	8
1⅜	17	4	8
1½	16	.....	....

Cement covered nails are used extensively in the cheaper patterns, as they hold nearly as well as screws and are put in much easier and cheaper. The sizes and lengths for these nails are as follows:

Size No.	Length inches	Size No.	Length Inches
2	1	7	2⅛
3	1¼	8	2⅜
4	1⅜	10	2⅞
5	1⅝	16	3⅜
6	1⅞	20	3⅞

The various kinds of nails and brads should be kept separated. Convenient ways for keeping the nails and brads in order are shown in the accompanying illustrations. The container shown in Fig. 1 may be fastened underneath the bench top. The device is made of wood about 3 inches thick and is attached to the bench in such a way that it may be swung in and out. When not in use, the container is under the bench and out of the way.

The nail or brad holder shown in Fig. 4 is made from wood or sheet iron. This container may be taken from the nail on which it is hung and laid flat on the bench while being used, and then hung up again when not in use. A cabinet containing several compartments is shown in Fig. 5. In this type, the brads fall forward on the inclined bottoms when the slide is lifted.

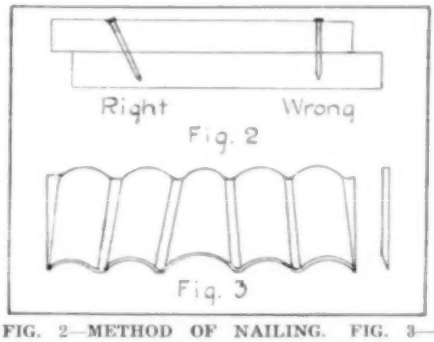


FIG. 2—METHOD OF NAILING. FIG. 3—CORRUGATED FASTENER

It is best to have nails or brads inclined or slanted when nailing two pieces of wood together. This feature is illustrated in Fig. 2, the correct and the incorrect methods being shown.

Practically all sizes of screws will be needed by the patternmaker because of their many uses, such as fastening patterns, dowel plates, fore plates for lathes, etc. Screws are much stronger than nails when put into the wood properly. A bit slightly smaller than the bottom of the threads near the point should be used if it is necessary to drill or bore for the screws. The addition of soap or beeswax rubbed on the threads will help the screw to enter hard woods.

Screws come in the same length but have different numbers, the various numbers designating the diameter, for example, 1-inch screws come in numbers from 3 to 20 inclusive. The system of numbering screws is just the opposite of nails, with screws the lower numbers denoting the smallest diameter. The screws are made in lengths ranging from ½ to 6 inches, and flat heads practically are the only ones used. The following sizes should be on hand for the general run of work:

Length inches	No.	Length inches	No.
¼	2 to 4	2	8 to 14
⅜	2 to 4	2¼	10 to 16
½	4 to 8	2½	10 to 16
⅝	4 to 8	2¾	10 to 16
¾	4 to 8	3	10 to 18
⅞	6 to 12	3½	10 to 18
1	6 to 12	4	10 to 18
1¼	6 to 12	4½	12 to 20
1½	8 to 14	5	12 to 20
1¾	8 to 14	6	12 to 20

A special type of fastener, called a corrugated steel fastener, may be obtained to secure the joints of wood. These fasteners are simple, easy to apply, of considerable strength and inexpensive. They are made in three styles, namely plain edge, saw edge and saw tooth divergent. The last mentioned have a wedging action causing the parts to bind, as well as hold together. This type is shown in Fig. 3. Fasteners of this kind are made with from two to seven corrugations and ¼, ⅜, ½, ⅝, ¾, ⅞ and 1-inch in depth.

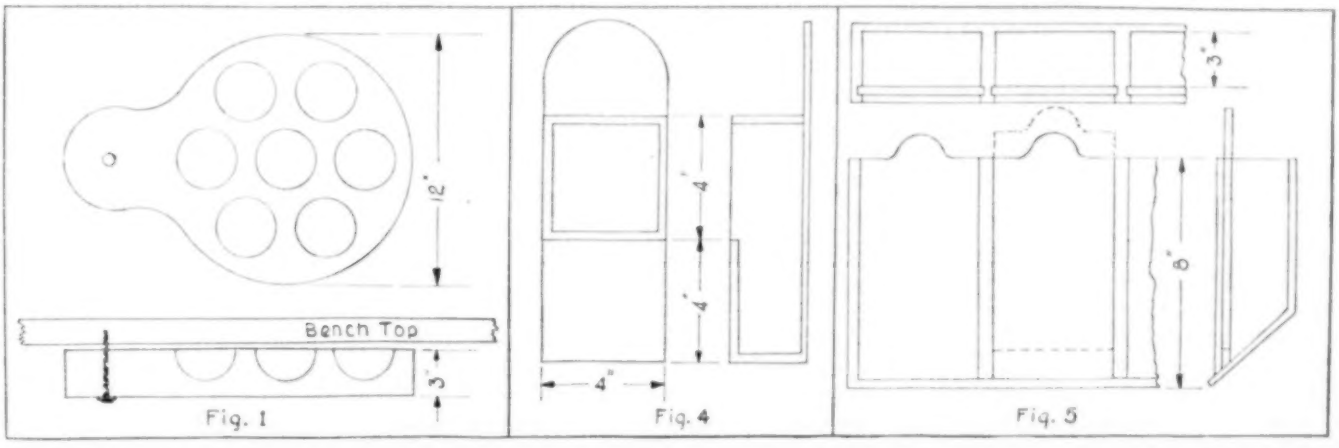


FIG. 1—SPECIAL TYPE OF BRAD HOLDER THAT MAY BE FASTENED ON THE BENCH. FIG. 4—CONTAINER TO HANG ON THE WALL. FIG. 5—HOLDER WITH VARIOUS COMPARTMENTS

Discuss Galvanizing Malleable Castings

Heat treatment as a remedy for embrittlement of malleable castings which have been hot dip galvanized was urged by L. H. Marshall, metallurgist, Ohio Brass Co., Mansfield, O., in a paper presented before the annual meeting of the American Institute of Mining and Metallurgical Engineers, held at the Engineering Societies building, New York, Feb. 15-17. In this paper entitles "Production of Non-Brittle Malleable Iron," Mr. Marshall reported that brittleness was noticeable particularly when the castings were quenched in hot water from temperatures between 570 and 1020 degrees Fahr. When the castings were quenched from the zone 1100 to 1380 degrees Fahr., impact values obtained were better than those in untreated iron.

Investigation showed that untreated castings could be heated to 1200 degrees Fahr. and quenched and then galvanized without embrittlement. It was also found that castings already galvanized and found brittle could be reclaimed by heating to the same temperature and quenching. Before this special treatment was developed, losses on one casting ran from 20 to 40 per cent. Use of the treatment reduced this loss to 0.6 per cent.

In discussing Mr. Marshall's paper, P. H. Brace, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., stated that experience at that company's plant indicated that brittleness was caused by the pickling bath and not galvanizing. He referred to a special malleable switchboard casting of thin section with which considerable difficulty had been encountered. He objected to the use of impact tests as the means for brittleness determination and advocated the use of tensile tests as the better index.

At a meeting of the nonmetallic minerals section on the opening day, R. M. Bird, George F. Pettinos, Philadelphia, read a paper "Mining and Preparation of Molding Sands," which described the production of Jersey sands in the Albany distruct. Stripping work, transporting, cleaning and screening the sand were discussed. In answer to a question, Mr. Bird stated that bentonite has excellent bonding properties, but inasmuch as it must be shipped in from Wyoming, its cost is prohibitive.

"Use of Standard Tests for Molding Sands," was the title of a paper presented by H. Ries, professor of economic geology, Cornell university, Ithaca, N. Y. Professor Ries described the apparatus used and advocated the standardization of sand grade designations as an aid to foundrymen.

Nonferrous metals received their share of attention at meeting of the institute of metals division throughout the sessions. A paper which attracted particular attention was "Modification and Properties of Sand-Cast Aluminum-Silicon Alloys," by R. S. Archer and L. W. Kempf, research bureau, Aluminum Co. of America, Cleveland. The Institute of Metals conducted its annual business meeting at a dinner on Tuesday evening and Paul D. Merica, development and research department, International Nickel Co., New York, was elected chairman, succeeding G. K. Elliott, Lunkenheimer Co., Cincinnati.

Coal predominates as fuel in the United States, according to a report of the coal and coke committee read at the coal session on Tuesday afternoon. Four principal fuels are in use and their present consumption is in the following proportion: Bituminous coal, 73 per cent; anthracite coal, 11.5 per cent; fuel oil, 10.3 per cent and natural gas, 5.2 per cent. The committee pointed out that probably the peak in the use of gas and fuel oil is about reached and that a reduction in their use should be expected. Various economic phases of the bituminous coal industry, about which considerable misinformation has been circulated, were discussed in the report.

At the annual business meeting on Tuesday morning, Samuel A. Taylor, consulting engineer, Pittsburgh, was elected president, succeeding J. V. W. Reynders. Other officers selected were as follows: Vice presidents, B. O. Mahaffey, Silurian Oil Co. & W. C. McBride, Inc., St. Louis, and C. A. Meissner, United States Steel Corp., New York; directors, L. K. Armstrong, consulting mining engineer, Spokane, Wash., W. S. Hutchinson, professor of mining, Massachusetts Institute of Technology, Cambridge, Mass., H. A. Guess, managing director, mining department, American Smelting & Refining Co., New York, S. W. Mudd, mining engineer, Los Angeles, and R. H. Sales, chief geologist, Anaconda Copper Mining Co., Butte, Mont. Dr. H. Foster Bain, 29 West Thirty-ninth street, New York, remains as secretary and C. F. Rand, New York, as treasurer. Dr. Thomas T. Read, director of the safety service of the United States bureau of mines, Washington, was elected assistant secretary of the institute.

Institute of Metals to Hold Meeting

The annual meeting of the Institute of Metals will be held in London on March 10 and 11 in the hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S. W. 1. The general meeting will be held on Wednesday, March 10, at which the reports of the council and of the honorary treasurer will be presented. The results of the ballots for the election of the council for 1926 and for new members will be declared. A selection of papers will be presented and discussed. From 2 to 4 p. m. another group of papers will be presented.

The following papers are expected to be presented: "Note on the Softening of Strain-Hardened Metals and its Relation to Creep," by R. W. Bailey; "Note on the Corrosion of an Ancient Tin Specimen," by Prof. C. O. Bannister; "Some Experiments on the Soft-Soldering of Copper," by T. B. Crow; "Determination of Zinc Oxide in Brass," by B. S. Evans and H. F. Richards; "Crystal Growth in Recrystallized Cold-Worker Metals," by W. Feitknecht; "The Interpretation of the Macrostructure of Cast Metals," by R. Genders; "The Hardness of Cold-Rolled Copper," by Samuel L. Hoyt and T. R. Schermerhorn; "Researches on the Nature, Properties and Conditions of Formation of Intermetallic Compounds with Special Reference to Certain Compounds of Tin—Parts I-V," by W. Hume-Rothery; "The Brittle Ranges of Bronze," by W. L. Kent; "The Influence of Gases on Copper at High Temperatures, Part I," by A. Glynne Lobley and Douglas Jepson; "The Die-Casting of Aluminum Alloys—A Review of Current Methods," by George Mortimer; "The Constitution of the Alloys of Silver and Tin," by A. J. Murphy; "Striation Due to Working or to Corrosion in Microscopical Metallography—A Contribution to the Study of the Mode of Action of Etching Reagents," by A. M. Portevin; "The Copper-Rich Aluminum-Copper-Tin Alloys," by D. Stockdale; "The Mechanical Properties at High Temperatures of an Alloy of Nickel and Copper, with Special Reference to Creep," by H. J. Tapsell and J. Bradley.

Papers for the autumn meeting of the Institute of Metals should be received by the secretary not later than May 19, 1926.

The Pulmosan Safety Equipment Corp., Brooklyn, N. Y., has moved from 45 Willoughby street to 386 Jay street.

Milestones in Foundry Progress

As Recorded in the March Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1896

GROVER CLEVELAND

ONE of the many trials and tribulations of the foundryman was related in the March, 1896 issue of THE FOUNDRY in an article describing the making of a 9-ton iron kettle in loam at the foundry of the Riverside Iron Works, Kansas City, Mo. When lowering the core, weighing 14,000 pounds, into place, the chain broke allowing the core to fall about 8 inches. However, no damage was done, as the air was compressed in the bottom of the mold, forming a cushion.

* * *

May 12, 13 and 14 were the dates announced for the national convention of foundrymen at Philadelphia. It was predicted that as a direct result of the efforts of the Philadelphia Foundrymen's association, seconded by the Chicago or Western association, the city of brotherly love again would be the birthplace of a national movement that would be of great benefit, not only to its members, but to all engaged in the business in any capacity.

* * *

A little sampling goes a long way in the foundry. To try new coke and new iron and run a shop besides that ain't adjusted automatically is a great deal more difficult than most people imagine. A test of any material is worthless unless properly conducted, and every little circumstance entering it is noted.

POKEY'S POINTERS

* * *

Tom Bowers evidently had a grouch against Pokey, the foundry manager, who would fall for any smooth talking salesman, and bought supplies promiscuously, regardless of the real value of the article.

* * *

Business was improving slowly in the Pittsburgh district. No. 2 foundry iron was selling at $12.50 to $12.75, Pittsburgh.

* * *

Some people, when they start an industrial work of any kind, go up about 200 feet in some skyscraper and have a set of drawings prepared, calculating the capacity of the works entirely from this source. When the plant is started, and the output does not come as called for, like wienerwurst from a sausage machine, thep step to the telephone and Hello and hello toward the manager.

KRANK'S KORNER

* * *

Yes, the thing often looks good on paper, but oh my, what a different story when actually tried.

Faked Foundry Facts

Shaking Out the Flask

1906

THEODORE ROOSEVELT

THE foundry of the Brown & Sharpe Mfg. Co., Providence, R. I., manufacturer of machine tools, was described at length in the leading article in the March, 1906 issue of THE FOUNDRY.

* * *

Some of the difficulties experienced in the alloying of nonferrous metals were discussed. It was suggested that metallurgists give a little time to the study of the chemistry of alloys instead of devoting all of their time to the problems arising out of the physical conditions and relations of metals.

* * *

A subscriber complained that the local board of health had required the elimination of smoke caused by the lighting of the fire in the cupola, and asked some reader to help him out of the difficulty.

* * *

Perhaps somebody suggested that a smoke consumer be placed on the cupola.

* * *

Foundrymen were warned of the necessity for careful work, since the prices received for castings had not increased in proportion to the cost of raw materials. The outlook for a busy summer was considered good. Foundry iron was quoted at $17.25 Valley and $14.00 Birmingham.

* * *

The Fort Pitt Steel Co., had applied for a charter and leased a plot of ground at McKeesport, Pa.

* * *

RUTHLESS RHYMES

Now William Smith, the foundry boss,
Took casting jobs at quite a loss.
'Tis said poor William turned quite pale,
When the shop was sold at receiver's sale.

Scoop

1916

WOODROW WILSON

DETAILS of molding practice in a large continuous foundry were given in a description of the Cleveland plant of the Westinghouse Electric & Mfg. Co., which was devoted to the manufacture of small electrical castings.

* * *

Foundry operations were being carried on at a high rate, the melt since the first of the year having established a new record. The question of an adequate supply of raw material for the remainder of the year fast was becoming acute.

* * *

Foundry costs were discussed in an article by John S. Watts describing a simple method adapted to the small jobbing shop.

* * *

D. H. Newland gave a description of the deposits of molding sand in the Albany district, as well as the methods of mining.

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Must Go and Get It

UNDOUBTEDLY, there was a time when the frequently quoted saying about the man making a mouse trap better than anybody else and the world making a path to his door in the woods was true. Perhaps at one time this system might have been employed for the successful distribution of merchandise. It was necessary only to make an exceptionally good article and the customer would seek the manufacturer to buy his product. Considerable differences could be found in the quality of manufactured goods, for hand methods predominated largely, and the manufacturer securing the workmen with the greatest skill produced the best article and realized a large share of the business.

Changes in methods of manufacture also have brought entirely different means of distribution. The introduction of machine methods practically has eliminated the vast differences in the quality of manufactured products of a similar nature, and has placed the producer of merchandise in a position where he must fight for his share of the business. Today, the consumer and his wants have become the dominating factor, with merchandise aggressively seeking the buyer.

SALES of various kinds of household appliances each year show an upward trend while the ingenuity displayed in disposing of this commodity clearly illustrates modern sales methods. Machines are displayed and operated at stores, fairs, exhibitions, and in fact at every conceivable place where the housewife will be present. In addition, salesmen with a pleasing appearance and a well-developed sales talk, thoroughly canvass all territories. They easily convince the lady of the house that there is a crying need in each home for the article offered and that much hard work and drudgery will be eliminated by its use. Easy payment plans are explained, and the sale is made.

The changing styles of distribution surely have a bearing on the success or failure of the foundrymen. Of course some casting plants make a finished article, and the owner of such a business is forced, by similar action on the part of his competitor, to go out and become acquainted with the consumer. On the other hand, the foundrymen making castings to be used in further processes of manufacture must find other talking points than just quality. Engineering developments and the removal of secrecy about practice in the industry has made it possible for foundrymen generally to produce work of approximately the same quality. Moreover, when the foundryman develops a good sales argument, he must go out after the business, must hunt up the consumer and give him not merely what he needs, but what he would like to have.

¶ Oxygen Is Slipping

AT LAST, after many years that elusive substance, oxygen in iron, may be pinned to the mat. Considerable discussion, pro and con, mostly con, has been carried on in the past few years about the effects of oxygen. The late J. E. Johnson was the champion of the beneficial effect of this airy element, claiming that it was the oxygen content of charcoal iron that made it strong and tough. Recently Eckman, Jordan and Jominy carried out some tests and obtained results contrary to those shown by Johnson.

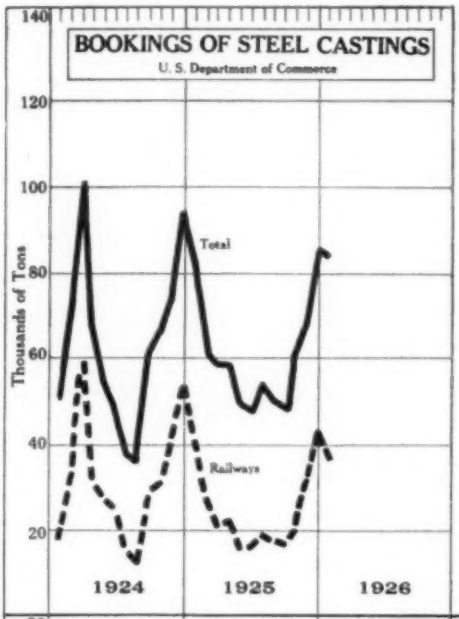
THROUGH a new method developed at the bureau of standards on the determination of gases in metals, enough analyses may be carried out on cast iron to determine exactly the effect of oxygen or other gases. We hope that many will avail themselves of this method and broadcast their findings. Reliable data on the effect of oxygen on cast iron would be of immense value to the foundry industry. Data of this nature not only would aid the foundryman in obtaining the best iron for foundry purposes, but also would enable him to check his melting practice. Thus he could kill two birds with one stone. Every one in the foundry would be happy—no more passing the buck from the cupola tender—the fault could be traced to the guilty party.

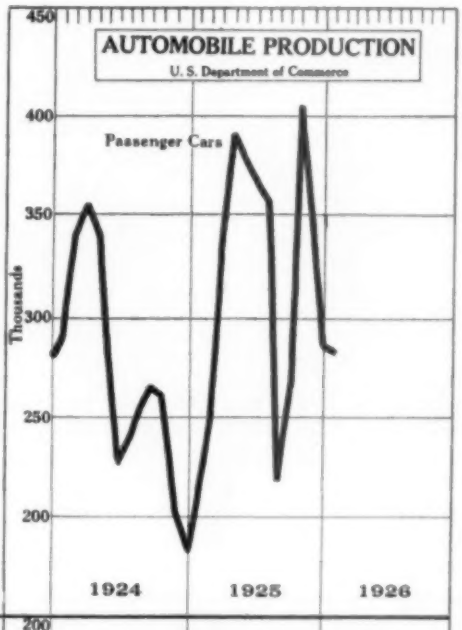
Trade Trends in Tabloid

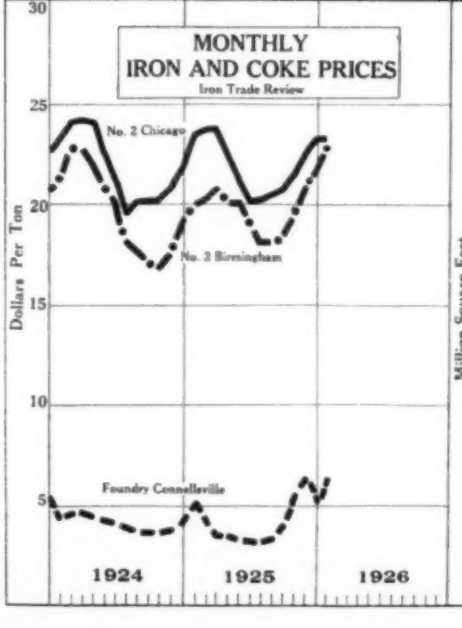
FOUNDRY operations throughout the country continue at a high rate, with every prospect for sustained business. Light and medium weight jobbing gray iron shops are busy, but those making heavy work are not quite so active. Demand for stoves furnaces and radiators is holding up through the winter season. Tire mold business is brisk, in keeping with increases in tire manufacture. Freight car awards have dropped slightly during January, the past month showing a total of 8832 cars against about 16,000 for December. However, the outlook for 1926 buying is regarded as favorable by car builders and makers of railway specialties. Automobile sales are reported to be slow, and production has gone ahead of delivery. The confidence of manufacturers in developing spring demand is attested by the fact that little curtailment is reported in delivery specifications on automobile castings. Demand for machine tools is improved. Nonferrous foundries are active, a fair volume of orders from plumbing goods jobbers serving to sustain operations in shops making this class of work. Farm implement sales are satisfactory and an increased demand for domestic machinery such as washers, ironers and refrigerating units is noted. A slight recession in building construction awards is attributed to the seasonal decline normally encountered at this time.

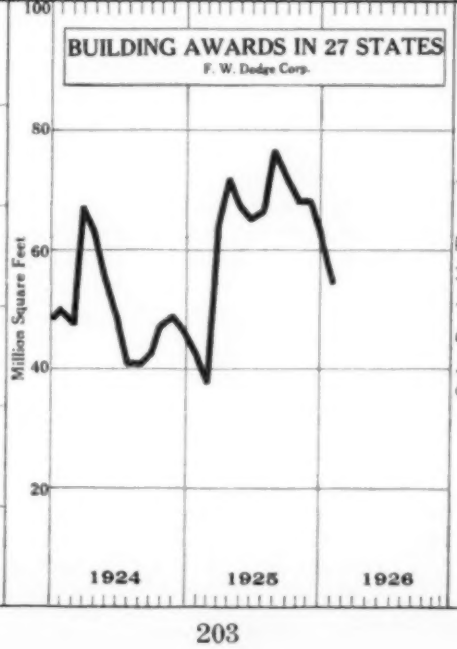
RAW MATERIAL PRICES
FEBRUARY 24, 1926

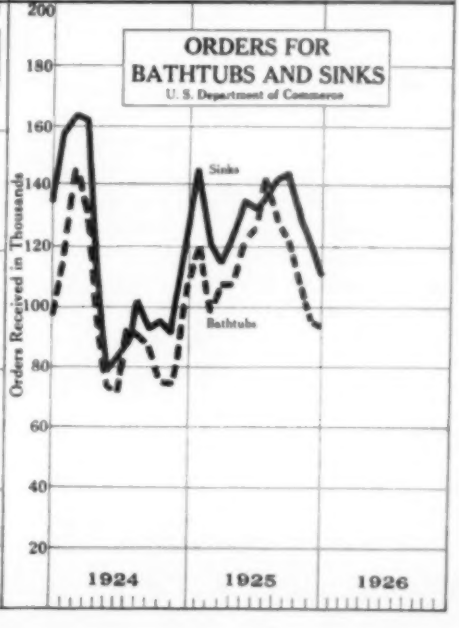
Iron	
No. 2 foundry, Valley	$20.50
No. 2 Southern Birmingham	23.00
No. 2 foundry, Chicago	23.00
No. 2 foundry, Philadelphia	23.39 to 23.76
No. 2 foundry, Buffalo	21.00
Basic, Valley	20.00
Basic, Buffalo	20.00 to 20.50
Malleable, Chicago	23.00
Malleable, Buffalo	21.00
Coke	
Connellsville foundry, coke	$5.00 to 5.50
Wise County foundry, coke	6.50 to 7.00
Scrap	
Heavy melting steel, Valley	$17.25 to 17.50
Heavy melting steel, Pitts.	17.50 to 18.00
Heavy melting steel, Chicago	13.75 to 14.10
Stove plate, Chicago	16.25 to 16.75
No. 1 cast, mach., New York	15.00 to 15.50
No. 1 cast, Chicago	18.75 to 19.25
No. 1 cast, Philadelphia	18.00 to 18.50
No. 1 cast, Pittsburgh	17.00 to 17.50
No. 1 cast, Birmingham	17.00 to 17.50
No. 1 cast, Buffalo	16.00 to 16.50
Car wheels, iron, Pittsburgh	18.00 to 18.50
Car wheels, iron, Chicago	16.50 to 17.00
Railroad malleable, Chicago	17.50 to 18.00
Agricultural, mall., Chicago	16.50 to 17.00
Malleable, Buffalo	18.50 to 19.00
Railroad malleable, Pitts.	18.50 to 19.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.62½
Electro copper, producers	14.30 to 14.37½
Straits tin	65.00
Lead, New York	9.12½ to 9.15
Antimony, New York	21.50
Nickel, electro	39.00
Aluminum, No. 12 prod'rs	26.50
Aluminum, No. 12, remelt	24.00 to 25.00
Zinc, E. St. Louis, Ill.	7.75











Comings and Goings of Foundrymen

C. R. SPARE has resigned as president and general manager of the American Manganese Bronze Co., Holmesburg, Philadelphia, and after April 1 will be associated with the Tanney Cylinder Co., Tacony, Philadelphia, in the capacity of vice president and general manager. Mr. Spare also is president of the Philadelphia Foundrymen's association. T. H. Addie, formerly vice president treasurer and sales manager of the American Manganese Bronze Co., has taken over the interest in that company formerly held by Mr. Spare, and has been made president and general manager. W. T. Tanney, president of the Tanney company also formerly was connected with the American company. The Tanney Cylinder Co., is a new company which recently was organized to make pump liners and nonferrous castings.

A. L. Foster, Corry, Pa., has been made a director of the Galion Iron Works & Mfg. Co., Galion, O.

J. A. Eves, general manager of Todd Construction & Dry Dock Corp., Tacoma, Wash., has been elected secretary of the Birchfield Boiler Co.

F. H. Melmoth has resigned his position as foundry manager of Lake & Elliott, Ltd., Braintree, Essex Eng., to act in a similar capacity to Thos. Firth & Sons Ltd., Sheffield. Major A. Rhydderch, B. Sc., is replacing Mr. Melmoth.

Benjamin D. Fuller, who for many years was connected with the Westinghouse Electric & Mfg. Co., Cleveland, has been appointed representative of Whitehead Brothers Co., Buffalo, in northern Ohio, Indiana, Illinois and Wisconsin.

A. L. W. Walsh has been elected president of the Lynchburg Foundry Co., Lynchburg, Va., to succeed the late Lawrence S. McWane, and succeeds to the duties of Fred. W. McWane, who has resigned after being general manager for six years.

Palmer E. Hanson has been made a director of the Automotive Foundry Co., La Crosse, Wis., and has been appointed foundry manager. Mr. Hanson formerly was connected with the Cream City Foundry Co., Milwaukee.

J. Lee Moses has succeeded B. F. Lawrence as purchasing agent for the Oklahoma Steel Castings Co., Tulsa, Okla. Mr. Lawrence resigned a few months ago to devote his attention to the Tulsa Brass Castings Co., Tulsa, of which he is president.

C. C. Ostrom, formerly agent in the Philadelphia district for the Vulcan Mold & Iron Co., Latrobe, Pa., has been elected president of Foster Merriam & Co., Meriden, Conn. Park & Williams, Inc., Real Estate building, Philadelphia, succeeds Mr. Ostrom as representative in the eastern territory for the Vulcan company.

A. G. J. RAPP

W. G. Langford was elected president of the Richmond Radiator Co., Uniontown, Pa., at a recent meeting of the stockholders. Other officers elected are as follows: A. H. Schroth, vice president; H. N. Kelley, secretary-treasurer, and N. St. Peter, assistant secretary-treasurer. The following directors were re-elected: Floyd W. Parsons, Hamilton Pell and Francis E. Smith.

S. D. Moxley has been promoted chief engineer of the American Cast Iron Pipe Co., Birmingham, Ala., succeeding James W. Moore, recently made general works manager. The new chief engineer, a graduate of the University of Alabama, has been with the American company three years, and formerly was with the Tennessee Coal, Iron & Railroad Co. Jesse W. Stalcup has been made auditor of the American Cast Iron Pipe Co., succeeding C. O. Hodges, promoted to treasurer. Mr. Stalcup started in the laboratory of this company in 1908.

National Engineering Co. Makes Changes

Several changes and additions have been made in the official personnel of the National Engineering Co., Chicago, manufacturers of sand mixers and sand handling equipment. H. S. Simpson now is president, T. S. Hammond, first vice president, S. T. Johnston, second vice president, and T. Kauffman, secretary-treasurer.

A. G. J. Rapp, who has been with the Link-Belt Co., Chicago, for 30 years, now is in charge of the engineering department of the National Engineering Co. This new department will supply engineering services as well as complete sand handling and sand preparing systems in connection with the sand mixer and the sand aerator and screen. The National Engineering Co. has specialized for 12 years in the manufacture of sand mixing and handling equipment. Mr. Rapp has had a wide experience in connection with the engineering developments in this phase of the foundry industry. Mr. Rapp started with the Link-Belt Co. as a draftsman then taking charge of the estimate engineering department and later the construction department. During the past 15 years he has had charge of the foundry development and engineering department. He is well known in the foundry trade, having installed a large number of sand handling systems.

Make Personnel Change

R. Charles Brower has been made assistant to H. J. Porter, vice president in charge of sales, the Timken Roller Bearing Co., Canton, O. Mr. Brower first became associated with that company in 1916 as district manager of the Bearings Service Co., with offices in Detroit. At the dissolution of that company in 1922, the Timken Roller Bearing Service & Sales Co., was formed with headquarters at Canton, and Mr. Brower was made assistant general manager.

Paxson Co. Completes Reorganization

The J. W. Paxson Co., Philadelphia, has been reorganized during the past six months, several changes in the executive personnel being made. The Paxson company has been engaged actively in the foundry equipment and supply business for 68 years. H. M. Bougher has been president of the company since 1908, having succeeded his father J. K. Bougher, who, with Howard Evans, Alfred Platt and J. W. Paxson, was responsible for the early growth of

HARRY W. TITGEN

the company. Mr. Bougher resigned as president in 1925, Albert Walton being elected president and general manager.

Mr. Walton was born in England and was educated at the Normal School of Science, South Kensington, London. He came to Philadelphia about 30 years ago and first became connected with the Pencoyd Iron Works, where he received his early training in the metal industry. Since that time, Mr. Walton has been identified in various executive capacities with a number of large industrial enterprises, and has been connected with the supervision of 14 foundries, five of which were under his direct control as chief executive. He also is president of the Diamond P Transportation Co., Philadelphia, and vice president and general manager of the Penn Facing Mills Co., Irwin, Pa., manufacturer of sea coal facings. Mr. Walton has been a member of the American Society of Mechanical Engineers for many years and has collaborated with prominent engineers in important developments in the engineering and manufacturing fields.

Other personnel changes include Franklin B. Platt, who has been made vice president, Harry W. Titgen, made chief engineer and manager of equipment sales and T. Watson Owings, manager of sand and supply sales. Mr. Platt has spent his entire business career with the Paxson company, he also being treasurer of the organization. Mr. Titgen has been with the company for 18 years, having developed a number of important improvements in foundry equipment of various types. Mr. Owings formerly was metallurgist and blast furnace expert with the Bethlehem Steel Works, and now is in charge of the sand and sales force of the Paxson Co.

Obituary

Prof. William W. Bird, president of Broadway Iron Foundry, Cambridge, Mass., for many years head of the mechanical engineering department of Worcester Polytechnic institute, died recently at Worcester, Mass.

Joseph Brower, aged 69 years, one of the pioneers in the iron industry at Birmingham, Ala., died recently in that city. He was born in Philadelphia where he learned the trade of iron molder. In 1885 he went to Birmingham where he organized the Avondale Stove & Foundry Co., serving as president until 1905 when he retired to be treasurer of another concern.

Lieut. Col. Lloyd G. McCrum, president of the Richmond Radiator Co., died at New Haven, Conn., Feb. 2, aged 48. Mr. McCrum started his career as a telegraph operator. He then went into newspaper reporting and at 19 became assistant postmaster at Allentown, Pa. In his early twenties he organized a firm that took over the Uniontown Acme Radiator Co. at Uniontown, Pa., joined it with the Richmond boiler works at Norwich, Conn., erected an enamelware plant at Uniontown, and associated with these industries a vacuum cleaner business. In 1922 he became general manager of the Richmond Radiator Co and a year ago became president of the company.

The Manley Sand Co., 527 W. Roosevelt road, Chicago, has been organized to represent the Rockton Molding Sand Co., Rockton, Ill. L. T. Manley is in charge of the office.

Discusses Engineering

E. S. Cohen, engineer, the Stoney Foundry Engineering & Equipment Co., Cleveland, addressed the members of the Quad City Foundrymen's association at a meeting held at Davenport, Iowa, Feb. 15. Mr. Cohen, who has had considerable practical experience in the foundry business, spoke of "Foundry Engineering." He suggested the necessity for an engineer to decide on the equipment for a plant, and warned against the purchase of more equipment than is necessary. He maintained that hand methods are economical unless the

ALBERT WALTON

tonnage being handled is sufficient to secure maximum work from the mechanical equipment. He also urged the members of the association to visit the plants of other members.

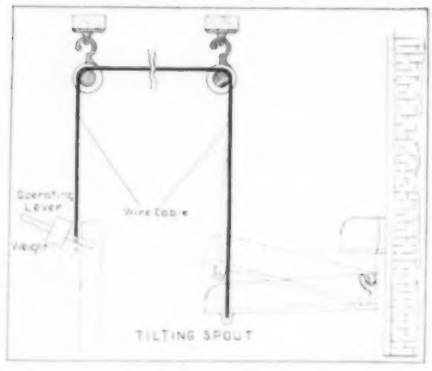
C. Howard Ross, Union Malleable Iron Co., A. E. Hageboeck, Frank Foundries Corp., and John H. Ploehn, French & Hecht were appointed on a committee to nominate officers for the coming year.

Albert Westenberger, manager of the iron and steel department, Beer Sondheimer & Co., Frankfort-on-Main, Germany, arrived at New York, Feb. 11 and expects to spend one or two months in this country with headquarters at the Plaza hotel, New York. Beer Sondheimer & Co. own or have an interest in mines in Sweden and Norway, and the firm was one of the founders of the Norddeutsche Hutte at Bremen. The firm also is interested in the manufacture of ferroalloys and the production of nonferrous metals in Germany.

Tilting Spout Reduces Foundry Accidents

The greatest number of accidents in the foundry occur while the heat is being taken off; the handling of molten metal in the vicinity of the cupola being especially hazardous. During a safety campaign at the plant of the Chicago Malleable Castings Co., West Pullman, Ill., about ten years ago, a special furnace spout for the cupola was designed by Carl Aabye, foundry foreman. During the period since this device was placed in operation, it has not been necessary to stop up the furnace while taking off a heat, and a man with a hand ladle has not caught in when bull ladles were used. The use of the spout also has reduced materially the running period, wiped out accidents and reduced the operation of the cupola to its simplest form.

As may be noted in the accompanying illustration, the tilting spout is supported at the cupola end by a hook attached to the main spout, while a wire cable passing over two pulleys and actuated by a lever and weight, operates the tilting end of the spout. The tilting spout is 40½ inches long, 13 inches wide at the cupola end and tapering to 10 inches in width at the pouring end. After lining, the spout is 11 inches wide at the top and 9¾ inches wide at the bottom of the large end and 8½ inches wide at the top and 7¼ inches wide at the bottom of the small end, the depth being 7⅝ inches at the large end and tapering to 4⅜ inches at the small end. The hook supporting the spout at the cupola passes through a hole 3 inches from the top of the spout. The spout is designed with sufficient capacity to permit its use in the place of reservoir ladles.



THE SPOUT MAY BE USED IN PLACE OF RESERVOIR LADLE

The spout is raised or lowered by an operator located at a convenient and safe distance from the spout. As shown in the illustration, the spout being raised or lowered simply by raising or lowering a lever, this lever being weighted to permit greater ease of operation. Pulleys and a wire cable support the spout.

Addresses Foundrymen

Various phases of production methods were discussed by H. M. Lane, foundry engineer, Detroit, in a meeting of the Newark Foundrymen's association, at the Downtown club, Newark, N. J., Feb. 19. Illustrating his address with steroptican slides, he devoted particular attention to handling problems. The speaker laid down no hard and fast rules, but warned foundrymen against the use of too elaborate equipment. He stated that every installation is an individual problem, and should be made only after a careful study of conditions.

Mr. Lane also stressed the importance of proper snagging and cleaning methods.

The association report on the apprenticeship work being conducted in the public schools was not encouraging. It being pointed out that considerable difficulty was had in attracting boys to the foundry course.

Handles Machinery Sales

The sales of the Jenkins Machine Co., Sheboygan Falls, Wis., manufacturer of woodworking machinery, now are being handled by the Yates American Machine Co., Beloit, Wis., Chicago, and Rochester, N. Y.

Appointed Representative

Herman Steinkraus recently has been appointed representative of the Bridgeport Brass Co., Bridgeport, Conn., in the Cleveland territory. For the past 8 years he has been connected with the Osborn Mfg. Co., Cleveland, having resigned recently from the position of sales manager.

Purchases Company

The Osborn Mfg. Co., Cleveland, has purchased the business of the Du-All Mfg. Co., that city. The Du-All Mfg. Co., will cease to exist as a separate company, the line of brushes being continued as a part of the line manufactured by the Osborn company.

Lavelle Foundry Co., Anderson, Ind., has elected T. A. Lavelle president, B. J. Lavelle vice president, H. B. McLaughlin secretary and Letitia Lavelle treasurer. Philip B. O'Neill was added to the board of directors, other directors being T. A. Lavelle, J. T. Lavelle, Harry McLaughlin, P. B. O'Neill, A. T. Dyle and B. J. Lavelle.

Foundry Association Directory

Chicago Foundrymen's Club
Chicago

CHARLES L. LARSEN, president, Armour Institute of Technology, 3200 Federal street, Chicago; E. C. BARRINGER, secretary-treasurer, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

The Buffalo Foundrymen
Buffalo

J. MCARTHUR, president, Washington Iron Works; W. J. WARK, secretary, E. J. Woodison Co., 164 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Detroit Foundrymen's Association
Detroit

ROBERT CRAWFORD, president, Atlas Foundry Co., 131 South Artillery street, Detroit; RUSSELL M. SCOTT, secretary, Packard Motor Car Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

THOMAS HARPER, president, Thomas Harper, 204 Lafayette street, New York; WM. E. PAULSON, secretary, Thomas Paulson & Son, Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

J. L. CARTER, president, Barlow Foundry, Inc., Newark; W. H. MANTZ, secretary, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

Ohio State Foundrymen's Association

WALTER L. SEELBACH, president, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; ARTHUR J. TUSCANY, secretary-manager, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

CHARLES R. SPARE, president, American Manganese Bronze Co., Holmesburg, Philadelphia; HOWARD EVANS, secretary, J. W. Paxson Co., Nicetown Lane and D street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

WILLIAM K. FRANK, president, Damascus Bronze Co., South avenue, N. S. Pittsburgh; WM. J. BRANDT, secretary-treasurer, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at the Port Pitt hotel.

Quad-City Foundrymen's Association
East Moline, Ill.

P. T. BANCROFT, president, John Deere Harvester Works, East Moline, Ill.; D. H. WARD, secretary-treasurer, Union Malleable Iron Co., East Moline. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island, and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

W. C. TROUT, president, Lufkin, Tex.; W. E DUNN JR., secretary-treasurer, Healey building, Atlanta, Ga. The 1926 convention to be held at Macon, Ga., the date to be announced later.

Tri-City Technical Council
Moline, Ill.

H. BORNSTEIN, chairman, Deere & Co., Moline, Ill.; MAX SKLOVSKY, treasurer, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Twin City Foundrymen's Association
Minneapolis-St. Paul

S. V. WOOD, president, Thirty-eighth avenue and Fifth street, Minneapolis; C. LANGDON, secretary. Meetings monthly at the Athletic club.

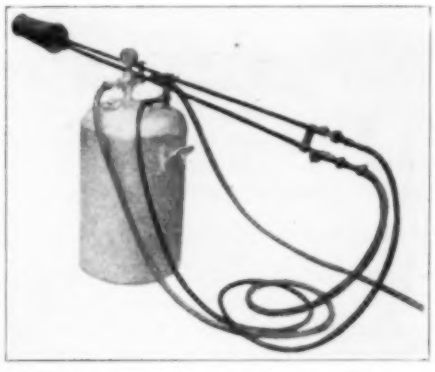
Bag Holder Is Portable

A bag holder truck designed to hold a bag while it is being filled as well as permit the operator to move the bags while being filled, recently has been introduced by the Chicago Mfg. & Distributing Co., Chicago. As shown in the accompanying illustration, the clamping device consists of a dog which is so balanced that when the bag is pushed down between the dog and the spreader, the dog automatically grips the bag. The broad face of the dog and the snubbing action of the bag over the spreader frame prevent tearing the bag. Loaded bags may be released from the holder by flipping one of the dogs. Any height up to 40 inches may be had through thumb screw adjustments. The frame is built on a 9-inch radius, the standards being made of wrought iron pipe. Small bags may be suspended from three or four clamps and two bags may be placed on the spreader by using the center dog twice. The base is made from a one piece alloy steel casting, high wings preventing the bag from rubbing the wheels. The cast wheels are 5½ inches in diameter.

THE HEIGHT MAY BE ADJUSTED EASILY

Device Preheats Castings

An oil burner and preheater for preheating castings prior to welding to neutralize expansion and contraction strains, and which may be used as a burner for core ovens, annealing furnaces, etc., recently has been introduced by the Alexander-Milburn Co., Baltimore. The burner is of the atomizing type utilizing the cheapest grade of crude fuel, kerosene oil or distillate, and compressed air under a pressure varying from 50 to 100 pounds. The air supply serves two purposes, namely to give a direct flow to the burner and to maintain a similar pressure on the oil storage tank. Both air and oil flow through straight line orifices. The oil under pressure enters the atomizing chamber at right angles to it and in an annular form, while the compressed air flows directly through the center striking the filament of oil and atomizing it, then expanding it in a venturi shaped outlet. The gas at the burner may be ignited and the work started immediately on opening the valves.

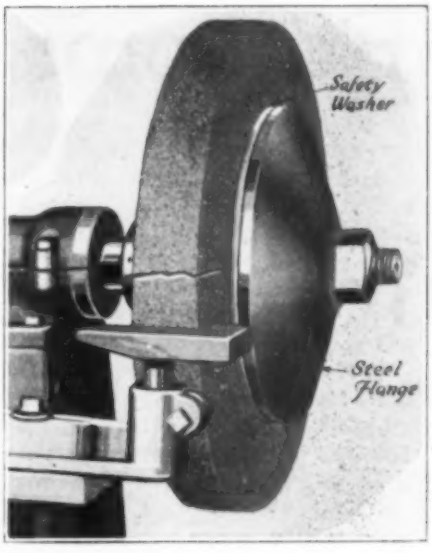


THE PREHEATER IS OF THE ATOMIZING TYPE

Elects Officers

Anderson Engine & Foundry Co., Anderson, Ind., has re-elected E. W. Cooney president and general manager. This company is the successor of the Anderson Foundry & Machine Co., which failed with the R. L. Dollings interest. Its record for the year is excellent and heavy bookings indicate further prosperity.

John T. Goodwin, Sheepbridge Coal & Iron Co., Chesterfield, England, recently remarked that better workmanship in the foundry should be encouraged by the payment of bonuses. He said that in a case he observed that the workman was stimulated to further good work.



THE RUBBER IS FORCED INTO THE POROUS WHEEL SURFACE

Washer Holds Wheel

A safety washer designed to eliminate some of the danger associated with the operation of grinding wheels has been introduced by the George W. Perks Co., Akron, O. The washer consists of metal disks having a specially prepared rubber vulcanized to one side. One of the washers is applied to each side of the grinding wheel with the rubber abjacent to the wheel. As the pressure of the outside steel flanges is applied, the rubber is forced into the porous surface of the wheel, securing it in place. The stress in the wheel, due to the centrifugal force is transferred through the medium of the rubber to the metal back of the washer and then to the shaft carrying the load. It is claimed that this device prevents a broken wheel flying out between the washers.

Plan Safety Congress

A safety congress will be held under the auspices of the safety division of the Association of Iron & Steel Electrical Engineers at Pittsburgh, Wednesday, March 10. The subject to be discussed at that time is "The Safe Operation of Electric Overhead Traveling Cranes."

Buffalo Foundrymen Meet

O. J. Abrahamson, assistant director, metallurgical and chemical department of the American Radiator Co. Buffalo, addressed the February meeting of the Buffalo Foundrymen's association at a meeting held Feb. 17. Mr. Abrahamson spoke on the subject of "Molding Sands Pertaining to the Foundry Industry."

Equipment Market Is Active

Record Sales Reported for February by Several Manufacturers as Buying Continues in a Number of Lines— New Construction Planned

BUSINESS in the foundry equipment market is good throughout the country. While an occasional manufacturer may be found who reports that the sale of equipment has not reached the total which was anticipated for this season, the majority of builders are securing a highly satisfactory volume and several report a record month for February. Included in the equipment which seems to be in greatest demand are the following: Cleaning room equipment, such as sand blast and tumbling barrels, molding machines and equipment for handling and preparing sand. Inquiries are heavy, many of which probably will be closed in the near future.

Several new foundry projects are being planned or started, for which it is expected considerable equipment will be purchased. E. J. Lavino & Co., Philadelphia, plan the construction of a cast iron pipe plant at Reusens, Va., the plant to be of the unit type, the first unit having a capacity of 100 tons per day. Plant additions also are planned by several companies, among which are the American Radiator Co., Buffalo; the Frank Foundries Corp., Moline, Ill., and the Boonton Foundry Co., Boonton, N. J.

Inquiries Point to Continued Buying

ALTHOUGH orders for foundry equipment still are scattered in the eastern district, the total volume is larger and prospects are the brightest this year, for in addition to several expansion programs actively contemplated, better business is being booked by the foundries. The General Electric Co., Schenectady, N. Y., has purchased a tilted type sandblast mill for its gray iron foundry from the W. W. Sly Mfg. Co., Cleveland. Shakeout bails have been secured by the A. P. Smith Mfg. Co., East Orange, N. J., from the Stoney Foundry Engineering & Equipment Co., Cleveland, while the Norfolk & Western Railway Co., Roanoke, Va., has purchased sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. The Lennox Furnace Co., Syracuse, N. Y., has ordered a sand cutting machine from the American Foundry Equipment Co., Mishawaka, Ind. The Herman Pneumatic Machine Co., Zelienople, Pa., has sold a molding machine to the Thatcher Co., Garwood, N. J. A sizable project under contemplation is that of Gilbert & Barker Mfg. Co., Springfield, Mass., which will allow for continuous pouring operations. The Boonton Foundry Co., Boonton, N. J., manufacturer of sash weights, contemplates increasing its foundry capacity from 17 tons to 25 tons daily. Richardson & Boynton, Dover, N. J., continues a buyer, having closed recently on sand handling equipment to the C. O. Bartlett & Snow Co., Cleveland. The Otis Elevator Co. has purchased a 3-ton electric furnace for its Buffalo plant from the Pittsburgh Electric Furnace Corp. The A. P. Grimm Foundry Co., Bound Brook, N. J., has closed on sand blast equipment and tumbling barrels from the J. W. Paxson Co., Philadelphia.

Pittsburgh Market Fairly Active

FOUNDRY equipment manufacturers and dealers have participated in a fairly active market in the Pittsburgh district for several weeks although in some directions disappointment is expressed over the fact that developments have not been as extensive as anticipated early this year. However, it appears that inquiries are being issued and prices obtained so that appropriations may be lined up and purchases made early in the spring. Several foundries in different sections of the country have bought single molding machines from the Herman Pneumatic Machine Co., Zelienople, Pa., of the large rollover type, and one or two have bought two or more apiece. That company has sold three machines to the Egan-Johnson Steel & Iron Co., Crum Lynn, Pa., and one each to the Keystone Driller Co., Beaver Falls, Pa., and the Fort Pitt Steel Casting Co., McKeesport, Pa. Vibrator and shakeout equipment has been sold to the Duquesne Steel Co., Coraopolis, Pa., by the Stoney Foundry Engineering & Equipment Co., Cleveland. The Blossburg Corp., Blossburg, Pa., and Duquesne Steel Foundry Co., Coraopolis, Pa., have purchased sandblast equipment, and the Standard Steel Works Co., Burnham, Pa., has bought sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. The Wildman Mfg. Co., Morristown, Pa., has purchased two tumbling mills from the W. W. Sly Mfg. Co., Cleveland. One or two core ovens and cupola propositions still are being worked upon, and these probably will develop into orders soon. A fair number of ladle orders are noted, and the Lava Crucible Co., Pittsburgh, has a good order book upon its product. The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. has purchased four cranes from the Northern Engineering Works, Detroit, for St. Louis, namely two single and two double hook cranes of 3-ton capacity. It now is in the market for a 5-ton crane for Sharon, Pa. The Pittsburgh Rolls Corp., Pittsburgh, awarded a 30-ton crane to the Morgan Engineering Co., Alliance, O.

Chicago Business Is Better

WHILE some lines of foundry equipment have been moving slowly, sales generally in February by makers in the Chicago district were heavy. One equipment interest never before in any one month did as much business as in February. Considerable old inquiry is being cleaned up but a fair amount of equipment is being placed directly. Buyers of sand mixers from the National Engineering Co., Chicago, include the A. O. Smith Corp., Milwaukee; East St. Louis Castings Co., East St. Louis, Ill.; and the Auburn Foundry Co., Auburn, Ind. The Oklahoma Iron Works, Tulsa, Okla., has

secured a molding machine from the Herman Pneumatic Machine Co., Zelienople, Pa. Purchases of cleaning room equipment include sandblast and dust arrester equipment by the Wolff Mfg. Co., Chicago, and sandblast equipment by the Key System Transit Co., Oakland, Calif., this equipment being secured from the Pangborn Corp., Hagerstown, Md. Shakeout bails have been ordered by the Clark Equipment Co., Buchanan, Mich., and vibrator and shakeout equipment has been purchased by the Waterloo Gas Engine Co., Waterloo, Ia., and the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., from the Stoney Foundry Engineering & Equipment Co., Cleveland. The W. W. Sly Mfg. Co., Cleveland, has sold a tumbling mill to the McQuay-Morris Mfg. Co., Connersville, Ind., eight large tumbling mills with dust arrester equipment to the American Foundry Co., Indianapolis, a tilted mill of the positive pressure type to the Service Brass & Aluminum Co., Wichita, Kans., and sandblast equipment to the Romeo Foundry Co., Romeo, Mich. Sandblast and dust arrester equipment has been purchased by the Moline Foundry Co., Moline, Ill., and the Crucible Steel Castings Co., Milwaukee, and a hammer core machine by S. Fair & Son, Inc., Saginaw, Mich., from the American Foundry Equipment Co., Mishawaka, Ind. The Illinois Foundry Co., Springfield, Ill., has purchased a small sand mixing machine from the Standard Sand & Machine Co., Cleveland.

New England Sales Heavy

RECENT foundry equipment sales have been heavy throughout New England, some manufacturers reporting a record business. A sand mixing machine has been sold to the Walworth Mfg. Co., South Boston, Mass., by the National Engineering Co., Chicago. Sand handling equipment has been purchased by the Potter & Johnson Machine Co., Pawtucket, R. I.; the Bridgeport Castings Co., Bridgeport, Conn.; Jenkins Bros. Mfg. Co., Bridgeport, Conn.; and the General Electric Co., Lynn, Mass., through Alexander Haigh, Boston. A new brass foundry at Woonsocket, R. I., has taken a core oven, tumbling barrel, sprue cutter and other equipment from W. S. Thomas, Providence, R. I. Crompton & Knowles Loom Works, Worcester, Mass.; the Brown & Sharpe Mfg. Co., Providence, R. I.; the Taylor & Fenn Co., Hartford, Conn.; the Chapman Valve Mfg. Co., Indian Orchard, Mass.; and the General Electric Co., Lynn, each have ordered four or more jolt rollover molding machines through W. I. Impey, Boston. The Crompton Knowles company also has secured a sand cutting machine from the American Foundry Equipment Co., Mishawaka, Ind. Dust arrester equipment has been secured by the Chase Metal Works, Waterbury, Conn., from the Pangborn Corp., Hagerstown, Md.

Cleveland Market Spotty

THE Cleveland market for foundry equipment has been spotty during the past few weeks. While the sales in several lines of equipment have slackened somewhat, molding machines, cleaning room and sand handling and preparing equipment seem to be in good demand. Inquiries are being brought out in fairly large numbers, and manufacturers look for good business in March. Repair business has fallen off. The American Radiator Co., which recently has closed on tramrail equipment for its Buffalo plant, is reported to be contemplating considerable expansion at that point, for which it now is securing figures on certain classes of equipment. The Erie Malleable Iron Co., Erie, Pa., and F. E. Myers & Bros., Ashland, O., each have purchased a tumbling mill; Phillip & Buttorff Mfg. Co., Nashville, Tenn., has taken two square tumbling mills; and McIntyre & Taylor Co., Toronto, Ont., has ordered sandblast equipment, this business being placed with the W. W. Sly Mfg. Co., Cleveland. The American Foundry Equipment Co., Mishawaka, Ind., has sold a sand cutting machine to the Ohio Pattern Works & Foundry Co., Cincinnati; a hammer core machine to the Buckeye Products Co., Cincinnati; and sandblast and dust arrester equipment to the Birmingham Machine & Foundry Co., Birmingham, Ala. The Columbia Sanitary Mfg. Co., Louisville, Ky., and the Standard Sanitary Mfg. Co., Louisville, have ordered vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. Sandblast equipment has been ordered by the L. N. N. Foundry Co., Cleveland, from the Pangborn, Corp., Hagerstown, Md. Sand mixing machines have been purchased by the New York Wheel Co., Buffalo, the Hayes Mfg. Co., Erie, Pa., the Buhl Malleable Iron Co., Detroit, the Lima Locomotive Works, Lima, Ohio, and the Gartland-Haswell-Rentschler Foundry Co., Dayton, O., from the National Engineering Co., Chicago. The United States Aluminum Co., Cleveland, has purchased a 3 ton crane from the northern Engineering Works, Detroit.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

F. M. Jacobs Foundry & Machine Co., Columbus, Miss., F. M. Jacobs president, will rebuild burned portion of its plant.

James Mitchell and W. H. Cane have been appointed equity receivers for the Fagan Iron Works, Jersey City, N. J.

Equipment is now being purchased for a new foundry addition for the A. P. Grimm Foundry Co., Raritan, N. J.

Hudson River Foundry Co., G. Donaldson, manager, Lansing avenue, Poughkeepsie, N. Y., will build a 2-story addition 45x75 feet.

The foundry building of the North & Judd Mfg. Co., New Britain, Conn., collapsed recently from the weight of snow on its roof. Plans for replacement have not been announced.

Mabry-Green Foundry Co., Beaumont, Tex., has been incorporated with $40,000 capital by C. D. Mabry, 2270 Broadway and associates.

Springfield Foundry Co., Liberty street, Springfield, Mass., will rebuild at once the portion of its plant recently burned.

The West Michigan Brass Co., Zeeland, Mich., is building a new plant which will be placed in operation soon.

Warman Electric Foundry Co., 3334 East Slanson Avenue, recently incorporated, G. B. Warman president, has bought 5 acres and is building plant 80x160 feet which will house 3-ton electric furnace and 5-ton electric crane for production of gray iron castings.

P. F. Mork Foundry, Beloit, Wis., is building an addition to its plant and will install an electric traveling crane.

Eagle Iron Works, Greenville, S. C., J. P. Thompson owner, was burned, the machine shop being saved. It will be rebuilt at once.

Topton Foundry & Machine Co., Topton, Pa., Nathan Kline president, will start rebuilding its burned plant at once.

United States Cast Iron Pipe & Foundry Co. is strengthening the trestle over the Big Four Railroad tracks at its Addyston plant.

near Cincinnati to permit easy transfer of pig iron from barges in the Ohio river into the company's stock yard.

Los Angeles Foundry Co., Los Angeles, is building a drying unit to dry its molds for a new class of work now being turned out.

Detroit Stove Works, Detroit, is taking bids through Charles Kotting, architect, for a plant 82x174 feet.

Wehr Steel Co., Forty-fifth and Gordon avenue, West Allis, Wis., will build a 1-story foundry 160x200 feet.

Record Foundry & Machine Co., Livermore Falls, Me., manufacturer of paper mill machinery, will rebuild and re-equip the portion of its plant recently burned.

May Brass & Foundry Co., Chicago, is making arrangements to move its plant to Ladoga, Ind., where larger facilities will be available.

Crucible Steel Castings Co., West Eighty-fourth street, Cleveland, will build a 1-story foundry 100x200 feet. George S. Rider Co., Century building, is architect.

Blackhawk Foundry & Machine Co., 323 Clark street, Davenport, Iowa, will build a 2-story foundry 100x110 feet at Clark and Hobson streets. (Noted Jan. 1).

Columbian Iron Works, Chattanooga, Tenn., will build an extension to its machine shops and build an office building at Chestnut and Twenty-fifth streets.

Simplicity System Co., L. B. West president, Volunteer building, Chattanooga, Tenn., will build a 1-story foundry and machine shop.

John M. Beery and E. P. Grant are forming company with $100,000 capital to build plant and establish a stove foundry at Rome, Ga.

J. Goldberg & Sons, 800 East Eighteenth street, Kansas Ctiy, Mo., have plans under consideration for addition to their foundry and machine shop.

Brombacher Iron Works, Los Angeles, Calif., has been given a contract for a foundry for the Warman Electric Foundry Co. at 3334 East Slauson avenue, designed for additional units later.

Republic Boiler & Radiator Co., M. H. Landis president, Union avenue, Woodbury, Md., Baltimore, Md., is making plans to enlarge plant and add to equipment to increase capacity 50 per cent.

Locomotive Stoker Co., 30 General Robinson street, Pittsburgh, A. L. Humphreys chairman of the board, will take bids soon for a 1-story addition, 30x180 feet. Hunting, Davis & Dunnells, Century building, are engineers.

George Cutter Co., South Bend, Ind., is having plans made for a plant including foundry, machine shop and assembly building. B. H. Prack, 119 Federal street, Pittsburgh, is architect. (Noted Jan. 1).

American Radiator Co., Buffalo, N. Y., is undertaking additions and betterments to its Standard plant, 22 Roseville street; a 1-story addition 100x300 feet and 100x330 feet to its malleable plant. (Noted Feb. 15).

Draper Corp., Hopedale, Mass., manufacturer of textile machinery, is making extensive alterations to its foundry from plans by F. P. Sheldon & Sons, 1008 Hospital Trust building, Providence, R. I.

Southern Car Wheel Co., Commonwealth building, Pittsburgh, is making plans for its new plant at St. Louis, including two units 80x260 feet and 65x225 feet. Robert & Co., Bona Allen building, Atlanta, Ga., are engineers.

Salamanca Foundry & Machine Works, Salamanca, N. Y., has been incorporated with $60,000 capital to operate a foundry and machine shop by J. Walrath, W. M. Green, and P. E. Luther. C. E. Congden, Salamanca, N. Y., is attorney.

Dreses Machine Tool Co., 227 West McMillan avenue, Cincinnati, radial drills and other machine tools, is building an addition for foundry use, with traveling cranes, 90x300 feet. The Austin Co., Cleveland, has the general contract.

Scientific Foundry Corp., New York, has been incorporated with 100 shares common stock no par value by W. H. Wilson, J. A. Walker and G. J. Vallare. Barry, Wainwright, Thatcher & Symmers, New York, are attorneys.

C. H. Hoppe Foundry Co., 373 West Grand avenue, Chicago, has been incorporated with $30,000 capital to build and operate a gray iron and semisteel foundry by C. H. Hoppe, E. T. Fisher and John Napier. Jesse R. Roberts, 76 West Monroe street, is correspondent.

Cummings Casting Co., 4533 Patterson avenue, Chicago, has been incorporated with $20,000 capital to conduct a gray iron and semisteel foundry by Daniel J. Lynch, T. A. Cummings Jr. and Margaret L. Cummings. Coburn, Kearney & Coburn, 77 West Washington street, are correspondents.

Chicago Hardware Foundry Co., North Chicago, Ill., is completing a 1-story brick and steel addition, 75x100 feet, to be used for assembling and finishing electrical hair dryers. The company is making this product as the result of the purchase of the Dry Blow Co., Syracuse, N. Y. No equipment will be purchased.

Frank Foundries Corp., Moline, Ill., and Davenport, Iowa, has purchased additional property at Davenport and will build a new cleaning room, machine shop and warehouse. This will increase the molding and core making capacity of the plant 50 per cent. Two acres of land have been purchased in Moline next to the present plant, and will be used to build another unit. This unit, when completed, will accommodate 100 molders. One third of this capacity will be built at once, including a foundry 100x200 feet, a core room 60x80 feet, a cleaning room 60x60 feet, as well as sand storage and miscellaneous other departments needed.

New Trade Publications

ABRASIVES—Artificial abrasives and their manufacture are described in a booklet issued by the Norton Co., Worcester, Mass.

TOOL GRINDERS—Gallmeyer & Livingston Co., Grand Rapids, Mich., has issued a bulletin illustrating its cutters and tool grinders, with full details of construction and operation.

STEAM GENERATION—A new type of boiler for steam generation is described in a booklet issued by the Combustion Engineering Corp., New York. The boiler is upright and said to be highly efficient.

REAMERS—Chicago Pneumatic Tool Co., New York, has issued a folder describing its new portable electric reamer. The reamer is made in three sizes and will ream holes from 15/16 inches to 1 5/16 inches.

SAFETY GUARDS—A wide variety of uses for which the Cutter Sheet Metal Mfg. Co., Cleveland, makes guards to promote safety is indicated in a current bulletin by that company, halftones of installations giving graphic examples of their utility.

METALLOGRAPHIC EQUIPMENT—Permanent alignment of microscope and illuminating unit is described in a bulletin issued by the Bausch & Lomb Optical Co., Rochester, N. Y. Details of construction and operation of this and other metallographic equipment are given.

WELDING SUPPLIES—Value of supplies of quality in welding, as well as machines properly designed is pointed out in a catalog of welding supplies issued by the Lincoln Electric Co., Cleveland. The catalog covers both machines and supplies for this use.

AIR COMPRESSORS—General Electric Co., Schenectady, N. Y., has issued a bulletin describing its centrifugal compressors for various uses. It is illustrated by halftones and phantoms, with operating characteristics and ratings.

ELECTRICAL DRIVES—Plant auxiliaries driven by electricity form the subject of a circular by the industrial department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. It is designed to aid in selection of the proper auxiliary drive that will provide continuity of service. Auxiliary pumps, fans, blowers, pulverized fuel equipment, motors and control are discussed.

POWER REGULATORS—Pittsburgh Electric Furnace Co., Pittsburgh, has issued bulletins describing power demand limitators for electric furnaces. One bulletin deals with the junior size and the other with the larger or senior size. The advantages of using these devices on electric furnaces also are given.

PATTERN SHOP—Supplies and equipment for pattern shops are shown in a catalog issued by the Kindt-Collins Co., Cleveland. Equipment such as saws, planers, sanding machines, etc., and the numerous supplies required are described. The catalog is well illustrated.

LIFT TRUCKS—A catalog featuring its lift trucks has been issued by the Barrett-Cravens Co., Chicago. It is illustrated by more than 50 installations of various types of trucks for industrial uses and also gives information on the breadth of application and savings effected through use of trucks of this type.

SAND TESTERS—A machine for testing the cohesiveness of sand is described in a folder issued by the Reynolds Electric Co., Chicago. A test bar of the sand is rammed on waxed paper and placed on the machine which winds up the paper. The overhanging edge of the bar breaks off and the amount determines the cohesiveness.

CONTROLS—An industrial control catalog has been issued by the General Electric Co., Schenectady, N. Y. It describes the different types manufactured by the company, their care and operation, wiring diagrams, push buttons and other accessories. It also contains reference tables, lists of publications and other information.

NICKEL STEEL—The International Nickel Co., New York, has issued two bulletins on the data and application of nickel steel. One covers the standard specifications for steel of the Society of American Engineers and includes that of steel castings. The other gives the physical and mechanical properties of nickel steels. These bulletins are part of a series of technical articles prepared by this company.